MODERN SCHOOL BUILDINGS

FELIX CLAY

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A TREATISE ON THE PLANNING, ARRANGEMENT, AND FITTING OF DAY AND BOARDING SCHOOLS

HAVING SPECIAL REGARD TO
SCHOOL DISCIPLINE, ORGANISATION, AND EDUCATIONAL REQUIREMENTS

WITH SPECIAL CHAPTERS ON THE
TREATMENT OF CLASS ROOMS, LIGHTING, WARMING, VENTILATION, AND SANITATION

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WITH NEARLY FOUR HUNDRED ILLUSTRATIONS, COMPRISING THE PLANS OF EIGHTY-FIVE SCHOOLS AND NUMEROUS FIGURES OF DETAILS AND FITTINGS

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PREFACE.

The published information on the subject of school buildings in this country, especially with regard to those for the purpose of secondary education, is curiously deficient. The writer of this work, when joining, some years ago, a body concerned with the building and management of a considerable number of Secondary Schools, felt very strongly the want of a book dealing with the ordinary questions arising in connection with their buildings. A careful search, however, elicited the fact that no such thing existed. There was of course Mr Robson's well-known "School Architecture," but this, brought out in 1874, a period when drastic changes in tuition and in the arrangement of school buildings were in progress, has become for the most part inapplicable to the modern style of school. It is also practically confined to the Board Schools of London, and a short chapter in it, with another in Mr Robins' "Technical School and College Building," represent the literature dealing with the subject of buildings for Secondary Schools.

The present volume is intended to supply this deficiency, and while both Elementary and Secondary Schools are included, the latter have been made its principal aim. They are dealt with before the Elementary Schools, on the ground that it is more desirable that the methods of Secondary School buildings should find their way into the Elementary Schools, than that those of the Elementary School should be adopted in the Higher Schools, as has hitherto been too much the case; probably owing to the fact that the books published on school buildings treat nearly all questions from the point of view of the Board School.

The book is itself a compilation of facts and information drawn from as many sources as possible, and illustrated by actually existing buildings, for the purpose of affording the necessary data from which a healthy and convenient building may be evolved. It does not attempt to suggest the lines upon which the perfect school of the future will be planned.

In its arrangement the object has been, first, to give a general survey of the conditions under which education is carried on,* with a sufficient account of the organisation and daily routine of the various kinds of schools, in order to convey an idea of the uses of the different rooms, their general requirements, and their relations to one another; and secondly, by giving the plans of a number of recent buildings, to show the different methods that have been tried to meet those requirements. Questions which affect the health of the scholars, such as lighting, warming, and ventilation, are considered at considerable length.

For much of the matter the writer is indebted to the many Head Masters and Mistresses who have been kind enough to go round their schools with him, and who made valuable suggestions as to the plan of the building from the point of view of the Principal of the school. The writer would like to take this opportunity of expressing his most sincere thanks to them, and to others who have helped with advice and suggestions, among whom the Dean of Manchester, Sir J. Fitch, Mr William Bousfield, Mr Basil Champneys, and Miss Mary Gurney should be mentioned as having given valuable aid.

The plans are in all cases, except those of schools from foreign countries, given with the permission of the architects who designed the buildings, whose courteous and ready assistance in offering every facility, both by the loan of drawings and in giving information, has alone made the production of the book possible.

FELIX CLAY.

September 1902.

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* The Education Bill introduced in 1902 proposes many and far-reaching changes. A short note of the suggested alterations has been added at the end of the First Chapter.

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MODERN SCHOOL BUILDINGS.

INTRODUCTION.

THE Board of Education preface that section of the "Code" which contains the Schedule of Instructions to Architects on School Buildings with certain general suggestions, among which is the following piece of advice: "The school architect is recommended first to perfect his plan. His own skill should then enable him to clothe it with form, proportion, character, and colour." * This is an excellent recommendation. Unfortunately it is difficult to know when the first part has been fully complied with, or who is to say when the plan has reached this stage of perfection. It seems, however, to suggest that either the making of the plan is too simple a matter to need the exercise of skill, better reserved for the elevations, or else perhaps that the instructions are so complete that the perfect plan will naturally follow a due observance of them. But useful as the regulations in the "Code" are from the point of view of requirements of hygiene, in regard to light and air, constructional details, &c., there are many points besides these which require consideration in the planning of a school, more particularly in the case of Secondary Schools. A knowledge of the organisation and daily routine of the kind of school is necessary in order to design a plan that shall help rather than hinder the master in maintaining an easy and effective discipline. As the organisation of a school depends principally upon the subjects taught in it, and the methods of classification, &c., adopted for the purpose, so it happens that the plan of a school comes ultimately to be governed to a large extent by the curriculum. As Mr Robson says, "The plan of a building depends so much upon the method of tuition, that an acquaintance with the latter is of the first necessity to the school architect." † For this reason

* See Appendix A, Building Regulations. † School Architecture, p. 3.

there is given in the following pages a somewhat longer and more detailed description of the organisation and educational systems of the different kinds of schools than might at first sight seem necessary in a book purporting to deal principally with school buildings ; and on the same grounds, since a certain number of German and American Schools have been illustrated, it was thought as well, in order to make the comparison of any value, to append a short account of their respective systems of education; sufficient, it is hoped, to make the plans intelligible.* For it is of little use to give the plan of some foreign school, however admirably it serves its purpose, to an architect who has not had the time or opportunity to acquaint himself with the method of school organisation for which it is intended. He cannot form any opinion as to how far the plan is suited to the requirements. Without a key to its intention he probably considers it from the point of view of how far it would serve the purpose of an English School. For example, an architect in this country would be not unlikely to condemn the plan of placing the assembly hall out of the way on the top floor of the building, the position in which it is usually found in Germany ; while a German would probably consider our plan of a large central hall, sometimes repeated, as in the London Board Schools, on three floors, a most useless waste of space. As a matter of fact, of course, in each case the position is well adapted to its purpose. The German hall is as a rule only used for special functions, of which examinations, obviously requiring a quiet place, are the most important ; while the halls in the schools of this country serve to collect the scholars at the beginning and end of the lessons, and being continually in use for various purposes, are naturally placed in the most central position.

If there is in the following pages a good deal of information the bearing of which on school planning seems rather remote, the excuse lies in the extreme difficulty of saying what may and what may not be of use to an architect, especially when having to advise on questions of accommodation, in relation to alterations and additions, as well as when planning a new building from the beginning. The relation between school discipline and plan has been treated at some length in the chapter on Secondary School planning.

We are so often told that we ought in this country to copy the German Schools and German methods that it may be worth while to

* In order to avoid a description of a number of foreign educational systems, the schools of other countries have been limited to those of Germany and America. The Continental Schools are planned on very similar lines, so that the schools of Germany may fairly be considered typical of European Schools.

shortly consider wherein lie the chief differences between the systems followed in the two countries. These are perhaps more noticeable in the Secondary than in the Elementary Schools, for in the latter, by the adoption of the present system of a separate class-room for each class with a responsible teacher in charge, the differences are slight, and more in matter of detail. The most essential difference between the two countries perhaps lies in the method of classification and promotion. In Germany a boy starts, usually at the age of nine, in the lowest form, and works steadily up the school. There are no sides for him to branch off into ; he has chosen his school, or rather his parents have chosen it for him, as teaching the subjects which it is desired that he should learn. He is not exactly promoted at any time, but goes each year through a regular course, starting with the rest of the form a new course at the beginning of the year, and so becoming one form higher. There is no reclassification for different subjects, the boy remaining always in the same form. If, as rarely happens, any boy is too backward to go on to the next year's course, he would have to spend another complete year in the same form. There are, as it were, a number of little schools in a large building ; a boy is with the same companions throughout his school life, each class being complete in itself, so that, given the number of years the school course is supposed to take, the minimum number of class-rooms is settled. In case of large numbers, many, or if necessary all the classes would be divided into parallel forms, so that, having provided a place for each boy in a class-room, the problem of accommodation is settled, there being no need to provide for divisions or small classes for special subjects.

In an English School, on the other hand, while the school is divided into a number of regular classes or forms with their form-master, the number of these has no reference to the period over which the school course extends, which, unlike the German plan, is of no fixed length, boys entering and leaving the school through a considerable range of age. These forms are split up, and the boys reclassified according to their ability for different subjects. For instance, a form of 30 or 40 may be subdivided into two or three divisions, say, for mathematics. For this lesson they will go to a different, *i.e.*, the particular mathematical master's class-room, there combining perhaps with divisions from other forms ; but the regular class-room will most likely be left unoccupied ; it being unusual, in the large public schools, to use the regular class-room except when the form-master is himself taking his own form. This of course necessitates class-room accommodation considerably in excess of the actual number of the school.

In Germany a parent chooses the school to which he will send his boy according to the curriculum that is taught and the time he wishes his boy to remain at school. The name of the school tells him at once all he requires to know as to its kind, scope, and curriculum. There are as a rule in every district schools of the different types. They are under Government control. Their efficiency is guaranteed by a stringently conducted inspection. The teachers are carefully selected, and have been properly trained. The father knows that his boy will get the sort of education he wishes, which is implied in the name of the school, and the best of its kind. An important factor in his choice of a school lies in the extent of the privileges to be gained by its leaving certificate. The successful completion of the full course of instruction in the different kinds of schools in Germany carries with it various privileges; such as one year's compulsory service instead of two in the army, and a higher status during that year; eligibility for various Government appointments; the right of entering certain professions, &c. The schools are as a rule Day Schools, and the fees are low.

The principles which guide a parent in his choice of a school in this country are of course very different. As a general rule the school is first determined on; and if a Boarding School, the choice need not be governed by any considerations of locality. Afterwards the question what subjects the boy is to learn is settled; so it comes about that every school practically teaches all subjects, thus giving rise to the system of classical and modern sides, special departments, &c., combining in one school a variety of curriculum that in Germany would be divided into two or three separate institutions. There are, however, many considerations which largely influence the English parent in his choice. Apart from the question of curriculum, there is the cost of the school; its social position and traditions; association, for instance he and his father were at such and such a school, so his son shall go there also, and carry on the name. He has no means of knowing whether the school is well managed or the teaching efficient; of the former he has to judge by the opinions of friends and past students of the school, of the latter by the results in scholarships and exhibitions. Probably in most cases the question of the efficiency of the teaching plays but a small part in determining his choice, for as it is usually a question of a Boarding School where the boy will spend by far the greater portion of his time for six or seven years, so important becomes the question of moral tone and feeling, the social status of the school, &c., that these questions naturally tend to assume the place of first importance, since after all it is in this life at school that the high

educational value of a great Public School to so large an extent depends, and it is on this side of our school life that foreign critics look with admiration and a desire for imitation, while finding much to criticise in the actual teaching.

In Germany* the system of secondary education, as well as the elementary, is a national institution second only in importance to the army itself. Regulated by the State, it has to bear the criticism of every German citizen, and is regarded as a matter of public concern and interest to a degree difficult to imagine in this country. Every one, down to the working classes, not only knows the aims and the privileges to be gained by the different grades of schools, but has an intelligent interest in and an opinion on the comparative merits of different educational questions. The result of this focussing of public opinion through a considerable period of time is shown in the completeness of their school organisation, and in the ease and rapidity with which small alterations can be made to suit any change in the requirements of any particular locality.

"Through the labour of generations, the Public Higher Schools for Boys in Germany stand, from certain points of view, and in many important respects, as models to the world. They are unrivalled in their high level of many-sided attainment. Thought has been lavished on the planning and concentration of their studies. The quality, the range, and the method of their teaching are under the watchful care of State inspectors, themselves experienced in the work of secondary education. All the schools are thus scrupulously kept up to an exacting standard of excellence. The teachers, almost all of them University men, are required to have passed through a course of professional training in the art of teaching." †

But while admiring the many undoubted excellences of the German School system, which has so often been held up to this country as a model that we should do well to copy, since Matthew Arnold as long ago as 1861 drew such strong attention to them, it is as well to bear in mind some of the objections often brought against it. For although the plan of study in German Schools is far less rigid than might be supposed from their centralised organisation, and the strict control exercised by the Government, it is impossible for a Day School, tied by the needs of the locality in which it is situated, to rival the elasticity of a Boarding School which can draw suitable pupils from a large area.

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* Special Reports issued by the Board of Education, vol. iii., pp. 87, 88.

† Vol. iii., Special Reports of the Board of Education: Problems in Prussian Secondary Education, M. E. Sadler.

Nor can experiments be tried, except to a very small extent, in schools which are obliged to conform to the curriculum and methods imposed by the Government, if they wish to be able to give their scholars leaving certificates, with their various privileges. It is further objected that the German School tends to produce men with well-trained and well-disciplined intelligence, but wanting in the power of original and independent action—qualities which the English plan of placing a large share of the responsibility of internal management and discipline in the hands of the older boys is well calculated to foster. While it is probable that the average German boy leaves school with a higher degree of attainments and knowledge than the corresponding boy in this country, it is at least open to question whether our system does not fit the boy better for making his way in the world.

The following book has been divided into two parts, dealing with Secondary and Elementary Schools respectively, and it will be as well to state the grounds on which the division has been made. To define secondary education is no easy task. The Royal Commission on Secondary Education in 1896, under Mr Bryce, finally, after much deliberation, gave as their idea of it: "Education conducted in view of the special life that has to be lived with the express purpose of forming a person to live it." This definition will of course include technical education, but as such subjects as German and French come under the head of technical, the Science and Art Department recognising any subject of instruction except Latin and Greek, it is hardly possible to separate the two. For the proper carrying out of this idea of education it is essential that school should not be left before the age of seventeen or eighteen. As a matter of fact, the leaving age gives the readiest and in many ways the most accurate means of placing a school.

In both Board and Voluntary Schools it is found that there are many scholars who, although they have reached fourteen, the age of legal exemption from compulsory attendance at school, and having also passed through all the standards, have thus completed the course of elementary education, are yet willing to stay and go on with their school work for another year, or perhaps two more years. A further year or two at school after having passed the seventh standard is of enormous value to the pupil, and the willingness of the parents to forego his earnings during this period ought to be warmly encouraged. Obviously it is of little or no use to transfer such pupils to a Grammar School or Secondary School of the usual type, since the curriculum of such schools is arranged on the understanding that not only the

pupil will stay on till seventeen or eighteen, but that he will commence at the age of ten or eleven subjects that are not taught to ordinary pupils in the Elementary Schools, and again is intended for pupils who will go on to the Universities and other places of advanced education. In order to take advantage of such a school a boy must have had his previous education arranged with a view to the wider course to follow. To introduce a boy or girl of fourteen into such a school for a year's finishing is a waste both of his time and that of the teacher. The methods of instruction are so different to those to which the pupil has been accustomed in the Elementary School, that it is a long time before any profit can be gained by the instruction given. On the other hand, the Higher Grade Primary School, which takes the pupil who has successfully passed through the ordinary elementary course, and gives him instruction the same in kind but higher in degree, finishing off and completing what he already knows, is exactly suited to his needs. It is an excellent preparation for the Technical School and even the Science Colleges, but with no pretence of aiming at the University. It is when the Higher Grade Schools begin to trench upon the province of secondary education that objections begin to arise and fault to be found with the unnecessary expense involved to meet the needs of a very small number of scholars. In September 1901 there were published by the Board of Education some instructive statistics on this point. The Higher Grade Schools earn a grant from the Science and Art Department by being enrolled as Schools of Science and giving the prescribed four years' course, the first two years being elementary, the last two advanced. The return mentioned above shows that there are forty-eight of these schools, with 8,700 scholars; of these only 2.8 per cent. go through the complete four years' course, 12.6 per cent. only getting beyond the second year. The London Schools with one exception show no fourth year pupils at all.

"When it is understood that this small percentage represents all the work done by these Boards which can by any pretence be called secondary education, and that the 1,100 odd pupils concerned could be taught at a nominal increase of expenditure in efficient Public Secondary Schools close at hand, it becomes very evident that the School Boards are engaged in a wasteful and hopeless enterprise." *

But in order that the pupil should be able to take advantage of the Secondary School it is essential that he should be transferred

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* *The Times*, 24th September 1901.

there by scholarship or otherwise at a sufficiently early age, probably not later than eleven or twelve. The important matter in any secondary education scheme is not to multiply mediocrity, but to have what Huxley called a "capacity-catching machine" which will ensure that clever boys will be picked out and efficiently taught. This might surely be more economically done by scholarships to Secondary Schools given in good time, though teachers are naturally averse from the loss of their most promising pupils, rather than by the building and equipping of very expensive buildings, to compete with and cover the same ground as already existing schools. The Higher Grade Elementary School is then merely an institution, and as such a most valuable and indispensable one for continuing and completing the Elementary School course, and is neither a Secondary School nor a link between the Elementary and Secondary Schools, nor is it a Preparatory School for secondary education, but is entirely an Elementary School.* As Lord Reay in his address to the School Board on their reassembling, 3rd October 1901, says :—

"A Higher Elementary and a Higher Grade School are not Secondary Schools, neither are they Preparatory Schools; they are the final stage of elementary education. If a Higher Elementary or a Higher Grade School attempts to give secondary education it is on the wrong tack, and if a Secondary School invades the province of Higher Elementary or of Higher Grade Schools it is not accomplishing its objects."

In this book the schools have been divided on this basis into secondary and elementary, the Higher Grade Schools being included in the elementary part.

There is not in this country an educational ladder by means of which a boy from the Public Elementary Schools can naturally work his way to the University as there is in America, where the Primary, Grammar, and High Schools are all arranged to follow one after the other, the Grammar School beginning where the Primary leaves off, itself the step to the High School, which does not take its pupils under the age of fourteen or fifteen. In order to make this arrangement work, it is necessary for the pupil to begin with a few subjects, adding others each year he remains at school; such subjects as modern languages being left till the High School is reached. This is just the opposite to the method in this country, where in the Secondary

* In France there is a very complete system of Higher Primary Schools which are under the same management as the Elementary Schools, and are kept quite distinct from the secondary education. See Special Reports, vol. i.

Schools a large number of subjects are begun early, to be very likely dropped afterwards, when the pupil shows a special aptitude for some particular branch, which at all events gives the pupil an opportunity of finding out what subjects are particularly suited to him. So that a pupil of fourteen coming to a Secondary School is a difficult subject for classification ; knowing nothing of certain subjects, he may in others be more advanced than pupils of a corresponding age already in the school. In America, the pupil from the Grammar School on entering the High School finds that the subjects new to him are also being commenced by the others of his age. But a complete educational ladder of this kind needs a social organisation very different to that of this country. In America, children of all grades of social rank attend the Public Schools. There are of course numbers of very good private and special kinds of schools with fees ; but these have not the position and importance which they hold in this country, and are to some extent discouraged on the ground of their tendency to intensify class feelings and racial differences. Even when the ladder is made complete as it is in America, and when social differences play so small a part, it is curious to note* to how small an extent it is taken advantage of ; and, involving as it does an arrangement of curriculum and tuition, the merit of which is at least open to argument, it may well be questioned whether the advantages of the free road to the Universities are worth the sacrifices entailed. Though the plan of transferring scholars from an Elementary to a Secondary School offers, as mentioned above, considerable difficulties, when the transfer is delayed, these can be reduced to an almost negligible quantity, if the pupil can be selected, and the change made early enough.

Secondary Schools and their arrangements have in the following pages been treated at considerably greater length than have the buildings for elementary education. For although the former class of schools are more intricate in their organisation, and their planning is greatly complicated by the great diversity of methods and systems, they have, as mentioned in the Preface, received comparatively little attention at the hands of writers upon school architecture. This may possibly be due to some extent to the fact that such schools are in

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* Some figures given by Miss Burstall in "Education in America," 1894, show that of the whole of the United States—

96.54	per cent.	are receiving	Elementary	Education.
2.53	,,	,,	Secondary	,,
·93	,,	,,	Higher	,,

most cases private institutions, so that there is a lack of the tabulated information, particulars, and opportunities of inspection so easily available in the case of buildings erected by School Boards.

Buildings for Girls' Schools have been considered in detail and largely illustrated. Such schools in their present form are a comparatively new development, and so, being more open to innovation and experiment, serve well to show some of the newer methods of school planning.

In the arrangement of the matter the plan has been followed of giving first a general sketch of the existing systems and organisation in schools of different types and the conditions under which education is carried on; then to consider the extent of accommodation necessary, entering with some detail into the requirements of the component parts of the building, comparing as far as possible the methods adopted in this country with those of Germany and America, and finally to show the arrangement of the buildings as a whole.

Complete plans have as far as possible been given, on the ground that it is more interesting and instructive to see the plans of all the floors of a smaller number of buildings than that of one floor only of a larger number. Constructional details that are common to all types of building have been as far as possible avoided.

In selecting the schools of which plans have been given, great care has been taken to try and show the different types of building. Those illustrated are for the most part recent, and embody the latest developments of school planning. It is not suggested that they show in all cases an ideal arrangement, or that they are merely models to be copied. They show how things have been done, not necessarily how they should be done. The aim of the book is to try and show to some extent the dependence of the plan upon the organisation of the school. As that changes so must the arrangement of the building. There cannot be, by the nature of the case, a model plan which will meet all requirements and suit all kinds of schools.

PART I.—SECONDARY EDUCATION.

CHAPTER I.

ADMINISTRATIVE AND GENERAL.

Secondary Education—Meaning of the term and what it includes—Difficulty of giving a Comprehensive Survey—Origin of our Older Schools—Grammar Schools—Origin of Private Schools—Rearrangement of Endowments by the Charity Commissioners, and Growth of Middle Class Schools—Difference between "Public" and "Grammar" Schools—Definition of "Public School"—Want of a definite nomenclature—Technical Schools and Institutions—Authorities who have Control over Secondary Schools, and their Duties and Powers—Public Financial Resources available for Secondary Education—The Royal Commission and its Recommendations—The Duke of Devonshire's Bill of 1899—The New Board of Education and its Officials—Consultative Committee—Comments on the Bill by different writers—Education Bill of 1901—Various Types or Grades of Secondary Schools, and the adequacy of the supply in different Districts.

THE term Secondary Education is usually held to cover all the schools which come between the Elementary Schools, and the Universities and great Technical Institutions—that is to say, between the schools whose course of instruction is arranged for those who do not intend to pursue their studies beyond the age of thirteen or fourteen, and the institutions receiving their scholars at ages from seventeen to twenty, who have finished their general education, and who wish for some form of specialised instruction in immediate preparation for the trade or profession they intend to follow.

The field covered is a very wide one, the term secondary including at one end the great Public Schools, such as Eton, Harrow, Winchester, &c., and at the other the little country Grammar Schools and small Private Adventure Schools, in some of which it may happen that the standard of education does not come up to that of a good Public Elementary School. These small, inefficient schools are rapidly disappearing.

The reason for including the Higher Grade Primary Schools in the section dealing with Elementary, and not with Secondary Schools, has been gone into in the Introduction, and need not be repeated here.

It is not easy to give a brief and comprehensive survey of the conditions of secondary education in this country. There has grown up a vast network of schools of an extraordinarily diverse character, but which vary from each other by such slight gradations in fees charged, subjects taught, and in the class of boys in attendance, that it is not possible to separate them, except in the roughest manner, into classes. There is, as a matter of fact, no uniform provision for the education of the middle classes in this country, and not only is the system of Secondary Schools incomplete in itself, but there is no regular connection with other forms of education above and below; overlapping at some parts, there are many others where there is no passage of communication. The want of a definite system of nomenclature undoubtedly adds to the confusion. It is rarely possible to give a name to any school which will at once convey a definite idea of its kind, or of its scope and curriculum. Some institutions are dignified by the name of College, though this is not generally intended to convey anything more than is meant by school, the terms being apparently interchangeable; the name College was most likely intended originally to convey some idea of superiority, probably in the social more than the educational sense. Even the name of "Public" conveys an almost exactly opposite meaning when applied to a Secondary School to that which it bears in reference to an Elementary School. The term secondary itself still conveys to some people a notion of inferiority, and is confused apparently with second grade. A Master of a Preparatory School, to whom the forms drawn up by the Royal Commission on Secondary Education had been sent, was quite indignant at the idea that any secondary education was given at his school.

It is not proposed to trace the rise of our Secondary Schools at length, but it may make their present position more intelligible if the method of their origin and development be briefly considered.

"The Ancient Grammar Schools" of England owe their origin mainly to the Tudor period. Before the accession of Henry VIII. there were but thirty-five such institutions in England, including Eton, Carlisle, and Winchester, and a few others which had been founded as charities, or were otherwise connected with ecclesiastical establishments. It was the dissolution of the monasteries which at once gave the impetus to the establishment of such schools, and furnished the means of sustaining them. During successive generations, down to

the period of the Civil War, nearly eight hundred "Grammar School" foundations were created.*

A number of these schools were also founded and endowed by various wealthy persons, to whom it seemed a very admirable form of charity to provide the means whereby poor but clever boys could acquire a good education, and when sufficiently able scholars, go on to the Universities and places of the highest education. It was for this purpose that in most of the older foundations there are carefully framed rules to ensure that at any rate a certain number of the places should be free, and that poor but deserving boys should be nominated for them by the Governors.

These Grammar Schools, started on much the same lines, had curiously diverse careers. Education at first was of a most simple character, the Classics, Latin and Greek, being considered not only the basis of education, but sufficient in themselves. At Eton, in the early days, even Mathematics was an extra subject.† Gradually, however, the curriculum was extended as the difference between the classes for which the schools had to provide became wider; and as the expenses, owing to the larger teaching staff required, &c., began to increase, the schools became more dependent on the fees which they received. Some of the schools, unable to meet the increased demand, fell out by the way, or dwindled into the small second-rate establishments of which the Secondary Education Commission drew such a deplorable picture; others, generally those who either had a larger endowment or one which happened to be of a kind that increased very much in value, were equal to the needs of the time, and gradually became the recognised educational centres.

Parents wishing to take advantage of these institutions began to send their children from a distance, thus necessitating the provision of boarding-houses; the advantages arising from the boarding system itself added to the attractions of these schools, and so grew up the great non-local schools, of whose boys perhaps not more than 2 or 3 per cent. are, at the present day, drawn from the immediate locality. New and expensive accompaniments to education were being continually added, and a more or less distinct course became established as the ordinary education of a boy in the upper classes, leading as a rule to the University; but the expense involved, and the length of time during which the education went on, practically

* Educational Aims and Methods, Sir J. Fitch, 1900.

† Teaching and Organisation, edited by P. A. Barnett.

confined it to the upper and wealthier classes. Increased facilities of locomotion naturally helped the Boarding School, and distance becoming of less importance, there was a natural tendency to the great predominance of schools that seemed to offer exceptional advantages.

Meanwhile the rapid growth of population and the discontinuance of the custom of founding and endowing Grammar Schools gave great impetus to the starting of Private Adventure Schools, a large number being what are known as "Preparatory" Schools, sending on their boys at the age of thirteen or fourteen to the various large Public Schools. These Preparatory Schools are a comparatively modern innovation, Mr Cotterill, in his Introduction to Vol. VI. of the Special Reports,* saying that he can find no traces of any true Preparatory School prior to the accession of Queen Victoria.

In recent years the pressing demand for good education for the middle classes at a reasonable cost has led to a great increase in the size and efficiency of a number of the older schools that had sunk to a very low pitch. The Endowed Schools Acts of 1869-74 enabled the Charity Commissioners to take in hand the old foundations, to reconstitute and rearrange their financial bases, and to alter, where it seemed advisable, the terms of the bequest to suit the needs of the times. In this way, and by appointing new governing bodies, they were able to set in good working order a large number of schools that had dwindled to a state of complete uselessness. In the great provincial towns a large number of schools have been started under the auspices of the local authorities of the type known as High Schools or "Grammar" Schools, in a different sense rather to the name as used in reference to the old schools. These schools aim at giving a first-class education, not so much directed at all-round culture or preparation for the Universities, as at a curriculum adapted to prepare their pupils for certain definite purposes with immediate reference to the trade or profession for which the boy is intended. The distinction between "Public Schools" and "Grammar Schools" is not easy to maintain; there are so many which contain the qualities of both, that it is a difficult task to say in which category any particular school should be placed. Generally speaking, the Public Schools are the usual road to the Universities, and used by a class socially higher and more wealthy than that attending the Grammar Schools. This is shown, too, by their organisation, for while both are as a rule divided into Classical and Modern Sides, in the Public Schools, where the larger

* Issued by the Board of Education, 1900.

proportion of the boys is composed of pupils intending to proceed to the Universities, the Classical Side greatly preponderates over the Modern—a few even, as Eton, Winchester, and Charterhouse, having rather special classes than a regular Modern Side. In the Grammar Schools, however, the Classical Side consists of a few boys, most of whom are probably going in for scholarships, the main bulk of the school is on the Modern Side, with special departments arranged for teaching commercial and mercantile subjects, great attention being paid to foreign languages, correspondence, and shorthand.

In the Public Schools Year Book for 1902 there are more than a hundred schools included, among which may be found schools of almost every degree. In the Preface, the Editors explain the principles by which they were guided in making their selection, and which is worth quoting, as showing how difficult it is to define what is meant exactly by a "Public School." "When the Public Schools Year Book was first projected, it was the intention of the Editors to include only the great historical Public Schools along with the more important Victorian Schools, which have so ably maintained the traditions of the earlier foundations. It was from the first recognised that the only line which could be drawn must be an arbitrary one. The term 'Public School' is in itself nothing more than a popular misnomer, and it was clear that guidance must be sought, not so much from what the term denotes as from what it connotes. Hence, in determining the inclusion of any particular school, the Editors asked themselves such questions as the following :—Does the school possess the 'Public School' spirit? Are its pupils entitled to be called 'Public School' men? Is it of more than local interest? What are its members, standard of teaching, and governing body?

Although opinions were drawn from various sources, and every effort was made to apply these tests in a conscientious and impartial manner, it must be acknowledged that the attempt was, from its nature, incapable of complete success.

The Editors accordingly declined to continue to undertake the responsibility of selection, and they decided to insert in future only such Public Schools as were connected with the Headmasters' Conference." *

It would, no doubt, be a considerable advantage to have some system of naming schools, by which it would be possible to convey a more or less accurate idea of the class of school. That adopted by

* Preface to Public Schools Year Book, 1902.

the Secondary Education Commission of First, Second, and Third Grade, according to the leaving age, seems liable to be too easily misunderstood to be generally adopted. It is again very difficult to draw a distinction between technical and secondary education, as every branch of teaching, except Latin and Greek, can be brought in under the head of technical, *i.e.*, a course of teaching designed to fit the person leaving it directly for their profession or trade.

Attention was turned to the subject of technical education after the Exhibition of 1851, and especially during the last twenty years there has been a very great increase of interest in this branch of education, leading to the foundation of a great number of technical institutions; and since a good all-round secondary education is an almost necessary foundation for effective technical teaching, and as, at the same time, a certain amount of technical training can be very advantageously given to pupils at Secondary Schools during their last year or two, in preparation for certain professions or examinations, it has naturally happened that many Secondary Schools have widened their curriculum and added facilities for teaching "special" subjects. The technical institutions have, in many cases, found it necessary, or at least advisable, to open a department in which a general education of an ordinary character could be given, as it was found that so many scholars came to them too ignorant of elementary subjects to profit by the advanced technical instruction.*

Early in the year 1894 a Royal Commission † was appointed to inquire into the whole question in order to consider the best methods of establishing a well-organised system of secondary education in England. At the time of the appointment of this Commission there was no one central authority dealing with secondary education. There were, however, certain bodies which had considerable powers, such as the Charity Commission, ‡ and the Science and Art Department. §

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* Any one interested in the growth and development of technical education in recent years will find a very complete and interesting account in the *Record of Technical and Secondary Education* for January 1900.

† Known usually from the Chairman as the Bryce Commission.

‡ *The Charity Commission.*—By means of the Charitable Trusts Acts, 1853 to 1891, this body exercises a general administrative and legal jurisdiction over the great mass of charitable endowments, and under the Endowed Schools Act it has the power of making schemes for the regulation of certain endowments.

§ *The Science and Art Department.*—This Department had a Secretary and permanent head of its own, and was controlled by the Lord President and Vice-President of the Committee of the Privy Council on Education, but was otherwise independent of the

There was also the Education Department. This was a Committee of the Privy Council, and though its main work lay in the Elementary Schools, it still touched secondary education at a good many points. It had to consider and approve the schemes of the Charity Commissioners, and in addition had jurisdiction over certain schools not coming under the Endowed Schools Act. It also controlled some Evening Schools where advanced instruction was given. The Board of Agriculture has the power of inspecting and giving grants to schools other than elementary, where instruction in agricultural subjects is given. The amount of grants so given amounts to about £8,000 annually. In addition to these, there are the local authorities which were left untouched by the Bill of 1899.

The local authorities* may be classed under three heads: (1) County Councils; (2) London; (3) County Borough Councils. These hold their powers under the Technical Instruction Acts of 1889 and 1891, and the Local Taxation (Customs and Excise) Act of 1890. The former Act gives power to County and Borough Councils and Urban Sanitary Authorities to levy a rate up to 1d. in the £ for the purpose of technical and manual instruction; while the latter provides a sum from the residue of the beer and spirit duties which may be applied to such educational purposes as come within the scope of the former Acts.

The other educational authorities dealing with secondary education are—Governing bodies of Endowed Schools; Managing Committees of Proprietary Schools and Institutes; Local Committees under the Science and Art Department; School Boards and Managers of Voluntary Schools so far as the schools under their charge give secondary instruction.

The Royal Commission, after having sat for seventeen months, issued its Report towards the end of 1895. The main recommendations made by it were, first, that an Education Office should be established under a responsible Minister, with a Permanent Secretary, and an advisory Educational Council of twelve members; secondly, that local authorities of definite and uniform constitution should be established in each county and county borough, in whose hands should be all local

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Education Department. Grants were given towards the establishment and maintenance of Science and Art Schools and Classes, and there were also medals and prizes for examinations, scholarships, exhibitions, and free studentships; aid to teachers in training at the Royal College of Science, the National Art Training School, and other approved centres; also building grants, and grants in aid of fittings and apparatus.

* These are the bodies under whose control the Act of 1902 proposes to put both Secondary, Technical, and Elementary Education. See Appendix.

secondary education, and who should be bound to see that sufficient means of secondary education were supplied in their district. It was further proposed that these local authorities should have the power of levying a local rate up to 2d. in the £. The non-local schools were to be exempt from the local authority.

For some years after the issue of this Report nothing was done, but in 1899 the Duke of Devonshire brought in his Education Bill, which adopted some but by no means all of the recommendations of the Royal Commission.

This Bill, which came into force on 1st April 1900, created a Board of Education which will ultimately absorb the functions of all the three central authorities, and have the sole control of primary, secondary, and technical education. The Board is placed under a responsible Minister. There will be a Permanent Secretary to the Board, assisted by two principal Assistant Secretaries for Elementary and Secondary (including Technical) Education respectively; the Secondary Department is divided again into two branches with an Assistant Secretary for each—the Literary Branch and the Technological Branch.

There is to be attached to the Board of Education a Consultative Committee, at least two-thirds of which shall be persons qualified to represent the views of Universities and other bodies interested in education. Further, the Act arranges for the inspection of all such Secondary Schools as shall apply to be inspected, drawing no line between administrative and educational inspection; but the Board is required to regard inspection by the Universities as equivalent to the official inspection.

This Bill, though very far from being an attempt to grapple with the whole task of organising secondary education, yet provides machinery by which it is possible that much may be done. As Dr Scott * calls it, it is a Bill of "great potentialities" rather than of things actually accomplished; pointing out that many vexed questions are left for future decision. The educational functions of the Charity Commissioners are to be taken over when it seems fit. No actual duties are assigned to the Consultative Committee beyond settling the conditions of the registration of teachers; inspection is left optional, and so on. The newly-appointed Board of Education does not seem to be much more than a rearrangement of the Science and Art and the Education Department. Instead of the three equal departments that

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* Education in the Nineteenth Century.

had been promised, under three Secretaries of equal rank, dealing with primary, secondary, and technical education respectively, there has been merely an altering of official posts, with the late Science and Art Department placed in control of secondary education generally, with a subordinate official entrusted with the charge of its literary and general side.

"To sum up, though no serious attempt has been made to deal with the problem of organisation upon the lines suggested by the Royal Commission, the reorganisation of the Education Department and the Science and Art Department with the Board of Education being merely a rearrangement of officials, who appear to be carrying on their work on much the same lines, there is now legislative recognition of a central authority for education, and the prospect of similar recognition of local authorities for counties and county boroughs, where there is a large amount of individual and local effort, which only needs official recognition." *

The public financial resources which are available for the purposes of secondary education are as follows :—

Endowments.—A sum of about £650,000 a year gross is available under the Endowed Schools Acts, with about £100,000 not subject to those Acts. In addition there are of course a number of endowments mounting up to a large sum, but which it is impossible to estimate.

Grants.—(1.) Given by the Science and Art Department. In 1900 there were in connection with this Department 2,330 schools, and over £300,000 was given in grants to Science and Art Schools and Classes.†

(2.) Grants given by the Board of Agriculture, as mentioned above.

(3.) Parliamentary grant for Evening Continuation Schools.

Funds.—(1.) Available under the Local Taxation Act from the residue of the beer and spirit duties.

(2.) Those that can be raised under the Technical Instruction Acts.

In addition to this there has been for some years a certain proportion of the elementary education rate in so far as it has applied to the maintenance of Higher Grade Schools giving advanced instruction. This use of the money was, however, in 1899, disallowed by the Government auditor, whose action was ultimately confirmed by the House of Lords. A short Bill was brought in to avoid the necessity

* *The Times*, 6th September 1900, Educational Progress, 1895-1900.

† Report of Board of Education.

of closing such schools. This Act made it possible for the County or Borough Councils to make the necessary grants of money to enable such schools to be carried on temporarily, pending the introduction of a measure dealing fully with the whole question.

In order to get some clear idea as to how far the supply of Secondary Schools was adequate to the needs of the population, the Royal Commission divided the existing schools into three grades for the purpose of tabulation. The results showed that there was a considerable want of certain kinds of schools. The grades were as follows :—

First Grade Schools.—The schools at which the pupils remain until the age of eighteen or nineteen comprise Endowed Schools, including the seven great Public Schools ; Proprietary Schools sending pupils to the Universities ; and Private Schools of the more advanced type.

Second Grade Schools.—With a leaving age of sixteen or seventeen. Endowed Schools ; Proprietary or Private Schools, which send in pupils for the higher classes of the College of Preceptors Examinations, or for the Oxford and Cambridge Local Examinations ; some Day Schools attached to Technical Institutes ; the highest departments of some Higher Grade Elementary Schools.

Third Grade Schools.—Leaving age fourteen or fifteen. Endowed Schools ; Private Schools, in which the ordinary standard is that of the third class certificate in the College of Preceptors Examinations ; Higher Grade Elementary Schools.

The deficiency in the supply of Secondary Schools is shown by figures taken from the returns for the seven counties selected for the purpose of the Report. The total number of scholars in the Endowed Schools in these counties amounts only to 2.5 per 1,000 of the population, and these small numbers are distributed with a curious inequality, for while in Lancashire the number is 1.1 per 1,000, it rises in Bedford as high as 13.5, and in Warwickshire it remains at 5.2 per 1,000, although that is a county particularly well supplied with Endowed Schools.

The Commissioners came to the conclusion that the supply of "First Grade" Schools for boys is on the whole sufficient, though for the children of the less wealthy classes the difficulty of access to such schools is still great. For this reason it is suggested that there might in large centres be a better supply of such schools ; but as a rule a Second Grade School which prepares for the local University is more

suitable than a First Grade School linked to Oxford and Cambridge. It is in the second and third grades that the real deficiencies of supply are found. Though the Higher Grade Board Schools are doing much to supply third grade secondary education, there are still many places where even this is wanting; while in many towns, especially the smaller ones, there is a great want of Second Grade Schools.

There is, no doubt, need for larger provision of means for transferring pupils from the Elementary to the Higher School. The system of doing this by means of scholarships has apparently worked well, but the plan requires considerable extension in order to make any adequate arrangements possible; the great difficulty lies in the question of the age at which such transference should take place. Educationally, it is necessary that a pupil passing from an Elementary to a Secondary School should do so not later than the age of eleven or twelve years. It is this retention in a lower school of a scholar who ought to be going on to a higher one that leads to a great deal of what is called overlapping; and which, it is pointed out in the Report, is due more to a deficiency in the supply of schools, the lower school trying to give education of a type really belonging to a school of a higher grade, owing to the want of such a school in the neighbourhood. There is, on the other hand, a considerable waste of power in trying to teach boys that are attracted to a higher grade of school before they are intellectually able to profit by the instruction.

Note.—**The Education Bill, 1902.**—The conditions under which education is at present carried on as stated in the above account will of course be much modified when the proposed Education Bill, 1902, becomes law. This Bill proposes to appoint local education authorities, to whom will be entrusted the entire control of the education, elementary and secondary, within their district, subject only to approval by the Board of Education. These bodies are to be the councils of every county and county borough. Their business will be to co-ordinate the different branches of education; in regard to higher education to consider the needs of their district, supplying schools when necessary, or assisting existing agencies; in the case of the Elementary Schools they are to take over the duties and powers of the School Boards established by the Elementary Education Acts, 1870-1900. They are further to have the power of applying money from the rates to the maintenance and current expense of Voluntary or Denominational Schools, provided that money is otherwise subscribed for the purpose of keeping the buildings of such schools in an efficient condition. In such cases one-third of the managers are to be appointed by the education authority, leaving the denominational managers in a two-thirds majority. This clause places the Voluntary Schools upon an equal footing with the Board Schools, as far as money for salaries and current expenses are concerned. The alterations made in the Bill in Committee, as far as it had gone at the moment of writing (viz., clause 7), render it likely that the Act itself will differ considerably from the Bill as proposed.

CHAPTER II.

THE ORGANISATION OF SECONDARY SCHOOLS.

The Connection between Organisation, Curriculum, and Planning—Old Types of Organisation—Classical and Modern Sides—Great Differences in the Secondary Schools of this Country—An Account of the Organisation of Wellington College, also of the City of London Schools—Comparison with various other Schools—St Paul's, West Kensington, Special Features—Difficulties in the case of Small Schools—Second Grade Schools—The Parmiters' Foundation School—Central Foundation School, Cowper Street—Abbotsholme and Bedales, Account of the latter—Question of Co-Educational Schools—Battersea Polytechnic.

THE organisation of a school is so closely connected with that of the curriculum, that it is hardly possible to consider them apart; and though the question of subjects taught and the time given to them may seem to have but a remote bearing on the plan of the building, yet as it is the subjects and method of teaching which settle the amount of reclassification and division, &c., they determine the extent of accommodation that will be required; and consequently the arrangements of the whole school building come ultimately to depend to a large extent upon the curriculum.

In old days organisation cannot be said to have existed. The whole school learnt the same limited number of subjects in one large school-room, so that the question of planning was settled when the size of the room to be built had been determined. The Headmaster devoted his entire attention to the sixth form, or to a few promising pupils, leaving his assistants complete control of the others. The boys usually worked their way straight up the school, and if the school routine did not suit them they left.

The first alteration took the form of additional classes, with an extra fee, taught out of school hours; later, such classes were arranged in school hours to suit those boys who did not intend to go in for high classical or mathematical work, or who were going into the army. The large school-room, which originally represented the whole of the teach-

ing accommodation, has been retained, though the plan of having a separate class-room for each form has long been customary; it being a great advantage to have a room of sufficient size for those occasions when it is desirable to collect the whole school together.

As a rule, the form master took his form in all subjects, with the exception of French and German, to teach which a foreign master was commonly employed. The arrangement and organisation of the work is now greatly complicated by having, in schools of sufficient size, special masters for each subject, thus necessitating a considerable amount of changing about from room to room, division of forms, and reclassification of the school for different subjects.

The plan of dividing the school into two or more sides or divisions is now almost universally followed. Either the whole school is so divided, and the boy chooses on entering the school into which side he will go, or else the lower part of the school is common to both sides, and it not until he has passed a certain form that the boy can determine which side he will take.

This latter plan is the one more usually followed, and has certain advantages. It puts off the necessity of settling the course of teaching till a later date, and so gives the boy and his parents or teachers more chance of finding out which he is best fitted for. It further tends to obviate one of the drawbacks of a completely divided school, which is the tendency of the two sides to become, as it were, two distinct schools. Sometimes the unity of the school is encouraged by the system of teaching the special subjects for which the division of the school is arranged in the regular classes, but reclassifying the whole school together for certain subjects which are common to both sides, and so to get an intermingling of the two divisions.*

A considerable number of schools have preparatory departments or schools in connection with them. In such cases it is easier to arrange a complete division of the school.

The Secondary Schools in this country differ so much in detail, and vary by such slight differences from the great Public Schools, such as Eton, Winchester, and Harrow, down to the small, badly-organised, ill-equipped Private Adventure Schools, whose educational standard would hardly come up to that of an Elementary School, that it is impossible to draw any line between them, or to give an account of any one school that would really serve as an accurate model; but as the main lines are more or less the same, a description in detail of one or

* Teaching and Organisation, p. 15, edited by P. A. Barnett.

two schools will serve to illustrate the principles on which they are arranged.

The following account of Wellington is taken from the Public Schools Year Book for 1901 :—

The school, which consists of about 470 boys, is divided into two sides:—

(1.) The Classical Side, in which the boys receive a general education, comprising Greek, Latin, Mathematics, Natural Science, French, and Geography, with Divinity and English subjects. This side is suitable for those who will go on to the Universities, or who wish to enter the medical or legal professions.

(2.) The Mathematical School, in which Divinity, Mathematics, German, French, Latin, Natural Science, History, Geography, and Drawing are taught in different combinations in the various forms.

Boys wishing to go into the Army join the Mathematical Side, eventually joining a special Army Class.

The number of forms in the school is twenty-four, which gives an average of rather under twenty for each form. A certain number of forms are divided into A and B parallel divisions, in which boys in the A forms learn German, in the B Science.

As an example of a large Day School, an account is given of the City of London School, taken for the most part from an account of it contributed by its present Headmaster, Mr A. T. Pollard, to "Teaching and Organisation," edited by P. A. Barnett. The school has been practically reorganised since 1889 under Mr Pollard, and may be taken as a type of a large London First Grade Day School. The school, consisting of 700 boys, is divided into—

(1.) An Upper School, divided into Classical and Modern Sides, with a Science Side parallel to the four highest forms of the other two sides.

(2.) A Junior School, which prepares for the two departments above it. In the Junior School are taught Scripture, English subjects, French, Latin, and Arithmetic, but provision is made so that if a boy desires exemption from Latin, he may be taught alternative subjects during the times set apart for that subject. This meets the case of a boy entering high up in the Junior School, with the intention of going on to the Modern Side, and who does not wish to take Latin. The times for teaching Arithmetic and French are synchronised so as to allow of boys being reclassified for those subjects, though Mr Pollard states that he finds this necessary only in special cases.

Classical Side.—The form work comprises Scripture, Latin, Greek, French, History, Geography, English, Writing, and in the higher forms except the sixth, a weekly lesson in Chemistry. German is not taught in school hours on this side, but classical boys can learn it in extra classes out of school hours. Boys are reclassified for Mathematics when possible, the principle being that the lower forms on the side constitute one "block" for the purposes of such redistribution, and the upper forms another "block."

Modern Side.—The form work comprises the same subjects, with the exception of Latin and Greek, which are replaced by more French and by German. Latin is taught as an alternative to Natural Science, which is taught in every form on this side. In the higher forms of the Modern Side great freedom in studies is possible, and the times at which different subjects are studied can be synchronised for the purpose of reclassification.

Science Side.—Boys are not admitted to this side till they have attained a certain literary and mathematical standard. The objects in view on this side are to prepare boys for (1) Science Scholarships at Oxford and Cambridge; (2) for the Preliminary and Intermediate Science Examination of the University of London; (3) for the engineering profession.

Generally speaking, most large First Grade Day Schools are organised somewhat on the above plan. Some schools supplement their Modern Side by special Army Classes, and boys are also prepared for the Navy Examinations. Other schools have a large number of special classes to prepare boys for certain examinations and for mercantile life.

Dulwich College has an Engineering Side, with a course extending over three years, in which is included Mathematics, Mechanics and Physics, Drawing, Chemistry, French and German, and practical work in the workshop.

At St Paul's School, West Kensington, with some 600 pupils, there is a Science Side of 220, with about sixty boys in the Army Department; there are a considerable number of special classes, but no boy is allowed to specialise until he is considered to have a competent knowledge of Classics. There is an admirable arrangement in force in this school, which virtually amounts to private coaching. If a boy is particularly backward in any subject, or requires special coaching, he is put into a sort of large class, which for the sake of convenience is taken in the hall, so as to allow of easy movement and plenty of room. This class usually consists of some forty boys. These each do their special work, and the masters, probably six or seven in number, move about and sit down by the side of the particular boy they wish to speak to. Any master who finds himself with nothing to do in school hours comes to this room and helps in the coaching. In case there is a boy who is rather above the work of the form he is in, and who ought to be promoted, he is first of all put in here and coached up till he is on a level with and knows the work required in the form into which it is desirable to put him. In this way it is possible, when required, to promote a boy without waiting till the end of the term, and keeping him on at work below his powers. The proportion of masters to boys in this school is high, the forms only averaging eighteen. The time table is arranged to allow of reclassification in almost all subjects.

University College School is arranged somewhat differently, the principle being that boys may be classified for every single subject, so that it is possible, though of course improbable, that every boy in the school should have a different time table. This takes away the sort of general control exercised over the boys

by the form master; and in order to make up for this, each boy is assigned to one of the masters as a consulting master, under whose care he remains while he is at the school. The consulting master is expected to watch the progress of the boys assigned to him, to encourage them to come to him in cases of difficulty, and when occasion arises to advise the Headmaster or parents in reference to the boys on his list.

There is in this school a special department for higher commercial instruction, with a two years' course, the subjects being Modern Languages, Higher Mathematics, Commercial History and Geography, Commercial Science and Descriptive Economics, Principles of Banking and Finance. The age limits of the school are from nine to nineteen.*

It is of course in the small schools that the great difficulties in the way of organisation are found. A permanent staff cannot be kept of sufficient size to have specialists for the different subjects, nor are there a sufficient number of classes to occupy their time. Classes have either to be very small, which means a waste of teaching power, or else there is too great an inequality of age and attainments to make level progress possible. Naturally the difficulties are more felt in a Day School where it is necessary to provide for the different needs of the people who live in the neighbourhood, than in the case of a Boarding School which can take up a particular line, and limit themselves to those pupils who wish to take up that line.

In the Second Grade Schools, where pupils do not, except in the case of a few special scholars, go on to the Universities or prepare for the Oxford and Cambridge Scholarship Examinations, the question of organisation becomes very much simplified, and the plan usually adopted is that of making certain subjects alternative in the higher forms. For instance, at the Parmiters' Foundation School, which has eight forms, in the three higher forms, Latin, German, and Shorthand are alternative subjects. Each boy may take one only, whichever will best accord with his future career, but he is required to learn one thoroughly.†

At the Central Foundation School, Cowper Street, the plan adopted is that of one school, but with a sixth form of four divisions, viz.:—

(1.) London Matriculation.	(3.) Technical.
(2.) Modern.	(4.) Civil Service.

French is taught throughout the school, as is also German, except in the lowest forms.

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* Public Schools Year Book. † Teaching and Organisation.

There remain a few schools which do not properly come under any of the above heads, but which ought to be mentioned. There is the school at Abbotsholme,* started by Mr C. Reddie, who has published an account of the aims and ideas of his school; and another school of a somewhat similar sort, though differing considerably in detail, under Mr J. H. Badley, at Petersfield, known as Bedales School. Having recently, by the kindness of Mr Badley, had an opportunity of seeing his school, I am giving a short account of the system followed there. Plans and a description of the building are given later (Fig. 221, p. 257).

Bedales is a Secondary School, keeping its boys through their whole school life; that is to say, they go there at the time they would usually go to a Preparatory School, and stay till the age of eighteen or nineteen, going straight on to College or to professional life.

I cannot do better than quote Mr Badley's own words, which give shortly the aims and objects of the school, which is a co-educational school, *i.e.*, taking girls as well as boys:—

"Shortly, then, Bedales represents an attempt to readjust the methods and enlarge the possibilities of education to meet the needs of a new time; and to give a real training, of body, mind, and character, that is not confined to one class or sex or portion of school life. To this end we attach much importance to certain rules of health; to good, plentiful, and varied food, not supplemented from home or the 'tuck shop'; to clothing that gives warmth and freedom, and to daily change for outdoor exercise, wet or fine; to fresh air freely admitted into every room that is being used; to regularity of daily habits; and to shorter hours of brain-work, varied with abundant muscular activity. The curriculum therefore includes, besides head-work, a large amount of training for hand, eye, and ear; and the head-work itself covers from the first a wider range than is usual, in order to serve as a broad foundation for specialisation in any required direction during the later stages. And in the school-life itself we have a great freedom of intercourse, treating the boys as responsible beings, neither doing everything for them nor leaving them entirely to themselves; and by this, and by the intermixture of the sexes, both on the staff and in the school, and by a wide range of age, we try to keep something of the life of a family with that of a school where there is a considerable amount of self-government."

The day is divided into three parts. The morning is devoted to head-work; there is an hour's work of a lighter kind in the evening, and for the older boys some preparation; but all the head-work is done between breakfast and dinner. The afternoon is taken up with various forms of hand-work and exercise, whether in the form of outdoor work in the garden or on the farm, or to games or expeditions. The remainder of the evening after class is divided between fixed times of singing and reading for all, and various optional occupations, such as carving or bookbinding, or to social gatherings for music, dancing,

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* Abbotsholme, C. Reddie.

lectures, debates, recitations, and so forth, in which all, in some form or other, have to take part.*

Work begins in the morning at 8.30. Two periods of varying length, according to the age of the class, from thirty to fifty minutes, followed by a break with a light lunch of biscuits and milk, followed by two more periods, make up the morning's work. The school is divided into three blocks—the upper, middle, and lower schools; these are all subdivided and reclassified, as may be necessary, and as the range of age in the school is large (from nine to eighteen or nineteen), there is naturally a great deal of classification necessary—meaning small classes and a large teaching staff.

After dinner every boy in the school has to change into flannels for games or outdoor work, and as they have to change again on coming in, they can go out whatever the weather. This necessitates a considerable supply of changing-room accommodation, conveniently arranged.

The school, as mentioned above, receives girls as well as boys. The girls have a separate boarding-house, but otherwise there is practically no difference made between them. They share in the classes and most of the games, and as far as can be judged, the effect is entirely satisfactory. Co-education of the sexes is so commonly a feature of American schools, and apparently succeeds well, as all authorities agree in speaking highly of it. The advantages of putting the boys and girls together, in the case of a small town of a size insufficient to maintain two schools, are of course very great, making a great saving in teaching power, buildings, equipment, &c. But this is of course another side of the question. At Bedales and certain other co-educational institutions it is done deliberately, for the sake of the moral and educational training gained by bringing up the two sexes together.

In Vol. I. of the Special Reports there is an account of the Secondary Day School attached to the Battersea Polytechnic, where boys and girls are not only taught together, but have a common membership of the various clubs and societies, and even take part in the inter-form hockey matches and games. The whole question is there discussed at some length.†

The school just mentioned, the Battersea Polytechnic, is what is known as an organised Science Day School, and is primarily intended for boys and girls who have passed through an Elementary School, and desire to continue their general education, or to receive training or preparation for the workshops and manufactory, the scientific branches, and other occupations in which a knowledge is required of Science, Technology, or Domestic Economy. The course of teaching extends over three years, and aims at imparting a thoroughly sound secondary

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* Bedales School: Outline of its Aims and System, J. H. Badley.

† See also Vol. VI.—The Co-education of the Sexes.

education, with special provision for the study of Pure and Applied Science, Manual Training, Workshops Practice, and Domestic Economy; but it is not intended that the training of the school shall replace the ordinary apprenticeship.

Admission to the school is limited to boys and girls who have obtained entrance scholarships from a Public Elementary School, or who have passed the sixth standard of the Educational Code or its equivalent, or provided that they can show the governing body that they are fit to profit by the advanced instruction. All applicants, except those holding scholarships, will be required to pass an entrance examination. The fees are, at the Battersea Polytechnic, £1 a term, but books and materials are supplied.

The above accounts of various types of schools will, it is hoped, help to make intelligible the different questions with regard to accommodation and arrangement of rooms that arise in the consideration of school planning.

Chapter III.

GIRLS' SCHOOLS.

Girls' Schools—Causes that have led to their institution in large numbers—Schools in existence at the time of the issuing of Report—North London Collegiate School, Description of—Description of Cheltenham Ladies' College—Origin of the Girls' Public Day School Company and the Church Schools Company—Work done by Charity Commissioners—Meaning of the name "High School"—Girls' Boarding Schools—**Organisation of Girls' Schools**—Routine of a High School—Kindergartens—Arrangement of Forms—Methods of Promotion, &c.—Curriculum—High Schools at Manchester, Examinations and Inspection—Boarding Schools—Girls' Schools at Ashby-de-la-Zouche—Fees, &c.—Physical Culture and Health—Games, Drill, and Gymnastics—Boarding Schools of the New Type—St Leonard's School—High Wycombe—The Roedean School.

The Report of the Schools Inquiry Commission, published in 1867, showed very strongly the want of efficient schools to provide for the great bulk of middle-class boys and girls. This want was felt far more strongly in the case of girls. For the boys there were, at any rate, a certain number of splendid institutions in the great Public Schools, in addition to a large number of schools which, if not altogether efficiently managed, had endowments of considerable value, and needed only a good scheme of organisation and an energetic use of their resources to become really first-class schools.

On the other hand, the opportunities of education open to girls were not only insufficient in amount, but extremely poor in quality, there being practically no schools sufficiently provided with endowments to be able to offer good teaching for a moderate fee.

There were, indeed, all over the country small Private Schools, but owing to the smallness of numbers, the lowness of their fees, and the difficulty of finding capable teachers, it was quite impossible for them to provide anything like an adequate or an efficient teaching staff. The Commission brings a heavy indictment against them: "It cannot be denied that our picture of middle-class education is on the whole unfavourable. The general deficiency in girls' education

is stated with the utmost confidence, and with entire agreement with whatever difference of statement or authority. Want of thoroughness and foundation ; want of system ; slovenliness and showy superficiality ; inattention to inclinements ; undue time given to accomplishments and those not taught intelligently or in any scientific manner ; want of organisation." *

So were described the schools in existence at the time of the issue of the Report. Obviously, what was wanted was some system of schools which should be large enough to allow of the pupils being properly graded, and having also sufficient numbers to keep the fees down to a reasonable amount. For many reasons it seemed likely that Day Schools would best meet the want.

There were, however, in existence at the time of the issue of the Report a few schools which could well serve as examples, the most important of these being the North London Collegiate School and the Cheltenham Ladies' College.

The former, opened in 1850 by Miss Buss as a Private School, but later organised much on the lines of a Public School, was by its transfer in 1872 into the hands of trustees made into a permanent public institution. This school may well be considered the type and forerunner of the Higher School of the present day.

The Cheltenham Ladies' College, opened at almost the same time, was intended to provide for the girls in the town the same advantages and privileges as those enjoyed by the boys at Cheltenham College. The curriculum was, however, restricted as compared with a modern High School, Mathematics, Science, Classics, and Physical Training being apparently not included in its early days.

These two schools stood practically alone, showing not only what might be, but by the force of contrast serving to make the inefficiency and shortcomings of the other schools more conspicuous. There are, however, now all over the country, schools, principally Day Schools, which, organised on much the same lines and teaching the same subjects as the first-class schools for boys, offer to girls the same opportunities of a first-class education at a small cost. Their origin and rise can be told in a few words. One of the first results of the revelations made by the Commission mentioned above was the inauguration of the "National Union for Improving the Education of Women of all Classes." The main objects of this association were to promote the establishment of good and cheap Day Schools for all classes above

* Report of the Royal Commission on Secondary Education, 1896, Introduction.

those attending the Public Elementary Schools, and in places where it seemed advisable, to establish boarding-houses in connection with them, though not necessarily under the direct control of the school authorities ; and, in addition, to encourage women to take to teaching as a profession, to raise the status of women teachers socially, and to try and secure properly trained and efficient teachers certified by examinations of recognised authority.

It was in order to carry out these ideas that the "Girls' Public Day School Company" was founded. This Company, inaugurated at a public meeting at the Albert Hall in 1872, was formed for the purpose of raising money to build or acquire and equip schools in which a thorough and sound education should be provided for girls.

Their first school was opened in 1873 in Chelsea with sixteen girls. There are now belonging to the Company in 1902 thirty-four schools with over 7,000 pupils. These schools, though all managed by the Council of the Company, are by no means exactly of a pattern, considerable latitude being allowed to the Headmistresses to organise and adapt their schools in such a way as best to meet the needs of their particular neighbourhood.

This example was soon followed by the foundation of the Church Schools Company, which originated in the idea that there would be a considerable demand for schools in which there was definite religious teaching according to the Church of England, all such teaching being, in the schools of the Girls' Public Day School Company, undenominational. As a matter of fact, this is not found to be the case to any large extent, and the schools of the former Company are usually established in different localities, and are, as a rule, much smaller in size than those of the older Company. Day Schools for girls were soon started all over the country, either by the formation of small local companies to provide for their particular district, or by means of funds contributed by the generosity of various persons or bodies—the great City Companies in particular having given large sums for this purpose ; in many cases the Charity Commissioners, in rearranging old-established educational charities and bequests, have been able to make provision for the establishment of girls' schools in addition to those for boys.

These "High Schools," as they are called, the outcome of the last twenty-five years, may be regarded as the typical girls' school of this country, *i.e.*, large Day Schools with moderate fees and no distinction of class.

The name High School requires a word or two of explanation. To

begin with, the word "High" is not meant to convey social superiority, but refers to the educational standard, though naturally, as the course of instruction goes on to eighteen or nineteen with fees that are high enough in many cases to make the schools self-supporting, the main bulk of the girls are drawn from the middle and upper classes; nor does the name at all correspond with the meaning attached to the word in the High Schools of the United States, where a pupil wishing to enter a High School must have previously passed through the Primary and Grammar Schools — in that country it forms a link between the Elementary Schools and the Universities, so that a pupil entering a High School must at least have reached the age of fourteen or fifteen. The following description fairly describes the position and scope of the English High School:—

"Our English High Schools provide both elementary and secondary instruction, and the ages of the pupils range from seven to nineteen. Hence, although there is a natural division between the Lower and Upper School, the work is closely connected; the same mistresses teach in both, and subjects such as Latin and French are usually carried down into the lower classes. The lower part of a High School is not exactly parallel to an Elementary School; the pupils have begun more subjects, they have been taught in smaller classes, and by different, less rigid methods. The High School cannot, therefore, at present be regarded as the middle rung of the educational ladder. In England there is a gap between it and the Elementary School, which is sometimes successfully bridged by special means, but the existence of which cannot be disregarded in any general scheme of English education. As the need of secondary education is more generally felt, a system of schools leading upward in direct line from the Elementary School is being naturally evolved, and connection between the two lines is being provided by scholarships and other means. But if we disregard a few exceptional cases, it seems best to look on the High School as an organic whole, taking the child from the nursery to the University, and sometimes even helping out the nursery, by means of the Kindergarten." *

Of course the High Schools do not by any means exhaust the field of girls' education; they are for the most part Day Schools, and though there are often boarding-houses in connection with them, they cannot be properly called Boarding Schools, as these houses are, in most cases, not under the control of the school authorities.

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* The Renaissance of Girls' Education, Alice Zimmern, 1898.

When the Girls' Public Day School Company, for example, grants licenses to boarding-houses, it is only to certify that the houses are in good sanitary condition, and large enough to take so many boarders; but beyond that their responsibility does not go, though of course the Headmistresses naturally take care to know how they are carried on.

A considerable demand has arisen in recent years for Boarding Schools, but of a very different type to those so strongly condemned by the Report of the Commission; for while any town of sufficient size to maintain a good Day School could provide an excellent education of the ordinary type, there often were a small number of girls who, wishing to try for scholarships, or working for difficult examinations, required special attention of an advanced kind, making additional teachers necessary; and while this could be managed in a large school, the expense involved made it difficult in a moderate-sized, and impossible in a small school.

The Boarding Schools were able to meet the difficulty of providing adequate teaching for these girls; as they could, by drawing from a large area, get a sufficient number requiring the same class of teaching to make it worth while providing the teachers. They also enabled those girls, of whom of course there were considerable numbers, who lived in the country at too great a distance from a Day School, to obtain the advantages of a good school.

ORGANISATION.

Although there is far more uniformity of scheme and organisation in the case of girls' schools than in boys', yet there is no regular code or system that will apply to all schools alike, each school varying as a rule in detail to suit the needs of the neighbourhood in which it is placed. There are, however, certain broad lines which are common to nearly all High Schools.

The first point to be noticed is that it is an almost universal plan that all regular class teaching should be given in the morning only, the hours as a rule being from 9 to 1.

The afternoon is reserved either for individual lessons, such as Music, Piano, and Solo Singing, Advanced Drawing and Painting, conversation classes in French and German, sometimes Greek and Advanced Chemistry. Preparation also is done in the afternoon. Girls who prefer to do so or who have no facilities for working at home stay or return to the school for the purpose. The object of this arrangement is to give

the best working hours of the day to the important subjects, leaving for the afternoon special work, preparation, and accomplishments.

For the regulation of the work done at home there are carefully prepared tables, assigning to each girl individually the amount of work that is considered right according to her capabilities, health, age, &c. These forms have to be filled up by the parents, to show how long the girl has taken over her preparation. In some schools forms are provided on which the girls have to enter how many hours have been spent in exercise out of doors. These precautions are found necessary in order to prevent the danger of overwork, for it is an objection often brought against High Schools that they are apt to overwork their pupils; but as Miss F. Gadesden, Headmistress of the Blackheath High School, points out—"The girl who comes to school young, and learns from the beginning to work with method, is rarely overworked. It is the girl whose early years have been wasted by incompetent teachers, who comes to school at fourteen or fifteen or older, and finds herself handicapped by want of knowledge and method, who becomes over-anxious and then overworked." * In all Public Day Schools Saturday is a whole holiday, and this, with the custom of having regular work in the morning only, cuts the available hours in the week rather short, making it very difficult to give adequate time for the great number of different subjects that have to find a place in the modern curriculum of a girls' school.

A large number of schools have a Kindergarten attached to them from which the children pass through a form, which is usually called the "transition form," into the school proper. The transition form is grouped for some purposes with the Kindergarten, sometimes with the first form; so that it is of considerable importance that their class-rooms should be close together, or arranged with sliding partitions, so that frequent changes can be made without too much waste of time and trouble.

The top form in the school is the sixth. It is not uncommon to have a special room for the pupils in this form known as the "sixth-form room," differing from an ordinary class-room by its furniture being fitted with a large table and chairs, and made to look more like a sitting-room.

The intervening forms, between the sixth at the top down to the lowest or first form, are arranged according to the size of the school

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* Education in the Nineteenth Century.

and the number of forms required, being divided into upper and lower, or in two parallel divisions, as may be most desirable.

The school is sometimes arranged with parallel divisions all the way up, the girls who take Latin going to one side, those learning German to the other.

In the arrangement of the classes it is usual to take certain subjects, such as Arithmetic and English, to determine promotion and position in the school, and to reclassify for other subjects by arranging that the teaching of those subjects shall synchronise in two or three forms, which are then treated as a block for the purpose of this subdivision.

In a large school where the forms can be properly graded, it is usual that the whole form should move up at the end of the year together, as in the German schools, any girl who is too far behind having to spend another year in the form. Of course in a small school there is too wide a difference in attainments to make this possible. Large numbers are almost essential to the proper and efficient working of a school. When the numbers fall below about 200, it becomes very difficult to grade the classes at all evenly, and either the backward are neglected or the clever ones kept back.*

The reclassification for so many different subjects entails of course a considerable amount of moving about from one class-room to another. There are usually four or five lessons in a morning, and it may easily happen that a girl is in as many different rooms in the course of one morning. Provided that the building is convenient and well planned, this, so far from being a disadvantage, provides a useful and pleasant change. But it is essential that there should not be long narrow corridors, awkward staircases, and dark corners, for unless the class-rooms are easily accessible, there is not only a great waste of time, but a considerable likelihood of disorder, as where supervision is difficult, discipline is not unlikely to suffer.

The school opens usually at 9. The girls, after having taken off their outdoor boots, for it is an invariable rule that only indoor shoes shall be worn in the building, assemble in the hall for calling over and prayers, after which they go off to their class-rooms. The morning of four hours is usually divided into five sessions, with an interval of about twenty minutes in the middle, during which the pupils have a glass of milk and a bun, to make up for the necessarily early breakfast, followed by a

* This would not, of course, be the case where the school is highly staffed, so that there can be a number of small forms of twelve to fifteen.

few minutes' fresh air in the playground. The main work of the day is over by 1 o'clock, but a very large proportion of the girls either stay and have dinner at the school, or if living near, go home and return in the afternoon for some of the special classes, or for games, which play a large part in the life of the schools.

The curriculum includes a large number of subjects. In the schools of the Girls' Public Day School Company, for example, the following find a place:—Religious Instruction, Reading, Writing, Arithmetic, Mathematics, Bookkeeping, English Grammar, Composition and Literature, History, Geography, French, German, Latin, the Elements of Physical and Natural Science, Social Economy, Drawing, Class-Singing and Harmony, Gymnastic Exercises, and Needlework, and in all the schools that prepare for College, Greek. This of course does not imply that every girl learns all of these. The Headmistress has considerable powers of selection among all these, and hence, as the best form of curriculum for Girls' Schools seems by no means as yet decided, there is considerable difference between the schools.

In the prospectus of the Manchester High School the subjects of instruction are given as—Reading, Writing, including Shorthand, English Grammar, Language, and Literature, History and Geography, Arithmetic and Mathematics; French, German, Latin, and Greek; Botany, Chemistry, Physics and Geology, Political Economy; Harmony, Class-Singing, Drawing, Cookery and Housewifery, Plain Sewing and Dressmaking, and Calisthenics.

Progressive courses of instruction are laid down in these subjects, but the authorities of the school will determine the particular course of instruction for each pupil, having regard to her health, ability, and attainments.

The curriculum of a school naturally comes in the end to depend on the examinations for which it prepares, for although it is only in the upper forms that actual preparation for the examination is done, yet the work of the school is naturally arranged to lead more or less up to them. The examinations of the Joint Board of Oxford and Cambridge are taken by a large number of schools. This has the great advantage of giving a standard of comparison, so that the work of one school can be tested by that of other schools of a similar kind. Girls also take the Cambridge Higher Local Examinations.

The North London Collegiate School is organised in two parallel courses, of which one leads to the London Degree Examinations, and the other to the Cambridge Senior and Higher Locals.

The work in Boarding Schools is on much the same lines; indeed,

except that the girls go home at night, there is not any very great difference at the present day between a High School and a Boarding School. The original idea of a Day School as a combination of school teaching and home influence seems merging more and more into a Boarding School, the home being used only as a kind of boarding-house; for what with clubs, matches, charities, old girls' meetings, &c., Sunday becomes the only day belonging to home. First come the morning lessons, usually five in number, with a short break for play or drill; then the school dinner, to which over fifty girls sometimes sit down. Again a short interval before the afternoon classes, music lessons and preparation, which usually go on till 4, though girls who have no special duties at the time may be found at play in the playground.*

In the Girls' Grammar School at Ashby-de-la-Zouche, which is a combination of Boarding and Day School, the ordinary subjects are taught, but extra fees have to be paid by those desiring to learn Greek, Latin, German, or Higher Mathematics. The fees, however, for the ordinary course are low, being £2 a term for those under fourteen, and £2. 6s. 8d. for those over. In this school the hours are from 9.15 to 12.30 in the mornings, Saturdays included, and from 2.15 to 4 o'clock in the afternoon, except on Wednesdays and Saturdays, when there is no afternoon school.

The actual hours available amount to about twenty, from which must be deducted the time occupied by prayers and calling over in the morning. This is of course exclusive of preparation and special subjects, such as music, &c.

Through all the question of curriculum, hours of work, &c., runs the question of health. Boys are generally presumed to be capable of protecting themselves from any danger of overwork, while in the case of girls stringent precautions are taken both to guard against this and to ensure that they shall get a proper amount of exercise and fresh air. At some schools extraordinary care is taken to look after the physical well-being of each individual pupil. At Sheffield (Girls' Public Day School Company), every girl has, on entering the school, to bring a certificate of health, upon which must be entered the more important details of physical development. In addition to particulars of weight, measurement, &c., there is a lady M.D. appointed to the school, who carries out these examinations, the results of which are entered in a book. In any cases where it seems advisable, special forms of drill or remedial

* The Renaissance of Girls' Education, A. Zimmern.

exercises are recommended, and carried out under the direction of the Gymnastic Mistress, who is a permanent member of the staff. Upon these records, too, the amount of home work and preparation is based, permission to play certain games, to join in the gymnastic classes, &c. This system is being gradually extended, and is carried out in a considerable number of schools, and the beneficial results to the general health of the school are very marked.*

At the Manchester High School the girls are measured and weighed at the beginning and end of each term, and their eyesight carefully tested by means of cards. This is done by the Head-mistress and the Science Mistress, not by a doctor; but in case of any pupil found to be going back in weight, or in any way not up to a normal standard of sight, the parents are at once communicated with, and a doctor called in.

There has arisen in recent years a considerable demand for a new sort of Boarding School for Girls, one which should be much more on the lines of a Boys' Public School, great attention being given to games and out-of-door pursuits, while giving an education of a high character, aiming perhaps chiefly at general culture, in which Classics should take an important place; and at the same time, by giving the girls in the upper part of the school a considerable share of responsibility in the management and discipline of the school, to train them in habits of independence and self-reliance.

The first school of this sort was founded in 1877 at St Andrews, and has been known as the St Leonard's School, since it acquired the buildings and grounds of the old St Leonard's College.

The school consists of the school-house and seven boarding-houses, each under the control of one of the senior assistant mistresses. The numbers are limited to 200, and the entrance age is from thirteen or fourteen to seventeen, no girl being admitted without first having passed an entrance examination graduated according to age.

Each house has a separate dining-room and study, where each of the elder girls has a small writing-table and bookshelf.

The school hours are from 9 to 12.30, with special subjects in the afternoon. No work is allowed before breakfast or after 8.30 P.M. There is a special games mistress, and one and a half hours are daily

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* Those interested in the subject will find an excellent account of the system in force at the Sheffield High School by Mrs Woodhouse, the Headmistress, under whose auspices it was introduced, in the second volume of the Special Reports of the Education Department, 1898.

given to games, after dinner. A playing field of 16 acres adjoins the school, providing a cricket field, golf course, lawn and gravel tennis courts, hockey ground, fives courts, &c. Great attention is given to games, and a healthy spirit of rivalry is kept up between the different houses by matches, each house having its own colours, and a keen interest is taken in these games.

The many advantages and attractions of this school, which began to draw girls from England in spite of the long journey, resulted in the foundation of The Education Company, by whose efforts another school has been established in the South of England at Wycombe Abbey, which has now accommodation for 200 girls.

This school, the Headmistress of which is Miss Dove, who had organised and set on a firm footing the St Leonard's School in the North, and had been induced to come and start a similar one in the South, is worked on very similar lines. The work is as far as possible broken up by frequent change and intervals, though there is no hard-and-fast division of class-work in the morning and preparation in the afternoon. Considerable time is given every day to physical and manual training, under which head come Drawing and Painting, Part Singing, Practising, Dancing, Carpentry, Gardening, and Needlework, all of which are regarded as part of the school work, and taught by teachers on the permanent staff.

The success of these schools shows that there is a real demand for "Public Schools" in the sense of the best class of Boarding Schools for girls.

Of a more advanced type is the school founded in 1885 at Brighton by the Misses Lawrence. The success of the school made it necessary to move into more convenient and larger premises. A site was secured between Brighton and Rottingdean, and the memorial stone of the new building, known as the Roedean School,* was laid by Mrs Sidgwick in 1897.

The curriculum is like that of a High School, with more scope for special and individual tuition.

The objects in view of the school are—To give a due importance to physical education and outdoor games in every girl's life, to regulate the school discipline in such a way as to develop trustworthiness and a sense of responsibility in the pupils, and give a sound and careful intellectual training.

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* Illustrated, Figs. 185-192.

CHAPTER IV.

GERMAN SCHOOL SYSTEMS AND AMERICAN EDUCATION.

German School Systems — Different States in Germany—Prussia selected for Description—Aims of German Secondary Schools—Exemption from One Year's Service in Army—Administrative Control of Education in Germany—Different Types of Schools—Their Organisation and Curriculum—Time Tables, &c.—Girls' Schools in Germany—State of Curriculum, &c. **American Education**—Enthusiasm for Educational Matters—Private or Denominational Schools—The Ladder from the Elementary Schools to the University—Uniformity of Different States due to Constant Communication—Administrative Control—Methods for raising Money for Educational Purposes—No Public Inspection by State Officers—The Different Grades of Schools and Description—Difference between English Idea of Secondary and Elementary Education and the American View—The Superintendent, his Position and Duties—Meaning of the Word "Class"—Use of the Hall—Private Schools.

IN considering the German system of education it must of course be remembered that there is, properly speaking, no German system, in the sense of one method common to all the different States. For the different States, differing as they do racially, politically, and on questions of religion, naturally have no absolute uniformity in their educational aims. But as Prussia assumes the lead, and is of greater importance in political questions, so when speaking generally of German education, it is the system in force in Prussia that is usually meant. Accordingly, as it would be obviously impossible to go into the methods of all the different States, and as they all follow more or less the same lines though differing in detail, the Prussian organisation is here described, sufficiently, it is hoped, to give such an idea of its general scope and aims as to make the plans of schools that are given intelligible.

The principal aim of the German Secondary School system is to produce in their pupils a high standard of all-round culture, but to a certain extent with reference to the particular line in life which lies before them. Their schools are most carefully and clearly differentiated into certain well-defined types with distinct names, which clearly denote the scope and objects of the school. Each school is limited to one particular type, not combining two sorts of schools in one, as for instance is usually the case with our Secondary Schools with their Classical and Modern Sides.

By means of a highly elaborate, but at the same time a smooth and easy working system of central and local administration, it is easy to compare the results of corresponding schools in different localities. This comparison, combined with the system of Inspectors, who are always men of high standing, usually, if not invariably, past Principals of schools, and so of experience in the work, makes it possible to test the value and efficiency of each school and so to ensure that all should be kept up to the same high level of excellence.

One point which has great influence upon secondary education in Germany lies in its close connection with the other parts of the national organisation. Successful completion of a six years' course in a recognised Secondary School gives not only exemption from one of the two years' compulsory military service, but at the same time a higher status during the one year. These leaving certificates have also a commercial value, as to hold one is a necessary qualification in obtaining a situation with any large firm. This naturally induces a very large number of boys to stay the full six years at school. Again the professions—Law, Medicine, &c.—and the Universities require the successful completion of a certain course which is settled by the Government. It is by this power of conferring on or withholding from schools the right to grant these privileges to their pupils that the Government can force them to conform to their regulations.

In Prussia the administrative control of educational affairs is vested in the Minister for Religious, Educational, and Medicinal Affairs. He is a Cabinet Officer and responsible to the Crown only, but practically he is bound by public opinion and precedent to carry on the educational work along certain definite lines. He acts as a kind of ultimate Court of Appeal from the decisions of lower departmental officers; his department covers a wide field; it controls examinations and the privileges to be gained by them; has the final voice in the questions of choice of studies; regulates fees; fixes the salaries and pensions of teachers.

Properly speaking, there is no Minister of Education, education being but one of three departments as mentioned above. This particular department is presided over by an Under-Secretary with two chief assistants. These, with the assistance of an Advisory Council of nineteen, administer the whole school system. Internally the department is arranged in two main divisions, to one belonging the Common Schools (Elementary), Normal Schools, High Schools for Girls, and the schools or institutions for defective children; the other taking charge of higher education in the Secondary Schools and Universities. The immediate

administration of the Secondary Schools is in the hands of the Provincial School Boards, of which there are thirteen, the President of the District being, when present, chairman *ex officio*. The place is, however, usually taken by the Governor of the District. The Board is as a rule composed of from three to five trained Inspectors, always selected from men who have been Principals of Secondary Schools. These divide among themselves the different classes of schools, the senior member taking the highest class of the school.

The duties of these Provincial Boards include the supervision of all matters relating to the educational institutions that come under their jurisdiction. They are required to inspect and report upon the Higher Schools, on the appointment and dismissal of teachers other than Directors (Headmasters). Their reports must be sufficiently full and exhaustive to keep the Central Department of Education fully abreast of the state of affairs in every school. They do not examine or grant certificates to teachers, this being done by a Special Examinations Commission.*

The curriculum of any Higher School must go somewhat beyond the subjects which may be considered to be absolutely necessary, it being the essence of a High School that it should give, to some extent at least, a liberal education. The Higher Schools of Prussia may be divided as follows:—

Classical Schools	*Latin and Greek.*
Gymnasien	Nine years' course.
Pro-gymnasien	Six years' course.
Modern Schools	*But keeping Latin.*
Realgymnasien	Nine years' course.
Real Pro-gymnasien	Six years' course.
Modern Schools	*No Latin.*
Oberrealschulen	Nine years' course.
Realschulen	Six years' course.
Höhere Bürgerschulen	Six years' course.

The Gymnasium is the highest class of school in Germany. It is the natural road to the Universities and the learned professions. Its aim is a high standard of all-round culture. It is divided into nine classes, one to correspond with each year of the course. Arranged in three divisions, the names of the classes, which it is convenient to know, as they convey at once a definite idea of the age and attainments, and are always found in the same numbers and arrangement in all schools, are

* German Higher Schools, J. E. Russell, 1899.

Ober Prima, Unter Prima, and Ober Secunda in the first division; Unter Secunda, Ober Tertia, and Unter Tertia the second; while the third division takes the classes Quarta, Quinta, Sexta.*

As a rule, a year is spent in each class, never less, but it may happen that a boy is not sufficiently advanced to be moved up, in which case he has to remain a second year in the same form.

To obtain admission to a Gymnasium the pupil must be at least nine years old, and must have had three years' training in Reading, Writing, Arithmetic, and Religion. This may be had either in the Elementary Schools or Private Schools, or better in the special Preparatory Schools which are attached to many Gymnasien, known as Vorschule. The following table, showing the hours of work for all classes, including the Vorschule, is taken from the Annual Report of the Breslau Gymnasium :—

Subject.	Number of Hours' Teaching a Week.											
	A. Gymnasium.									B. Vorschule.		
	I*a*.	I*b*.	II*a*.	II*b*.	III*a*.	III*b*.	IV.	V.	VI.	1.	2.	3.
Religion	2	2	2	2	2	2	2	2	2	2	2	2
Mother Tongue and Narration of National Events	3	3	3	3	2	2	3	3	4	8	8	12
Latin	7	7	7	7	7	7	7	8	8	...	...	...
Greek	6	6	6	6	6	6	...	...	...	...	...	...
French	2	2	2	3	3	3	4	...	...	...	...	...
Hebrew *	2*	2*	...	...	...	...	...	...	...	...	...	...
English *	2*	2*	...	...	...	...	...	...	...	...	...	...
History and Geography	3	3	3	3	3	3	4	2	2	...	...	...
Mathematics	4	4	4	4	3	...	4	4	4	4	4	8
Physics and Natural Science	2	2	2	2	2	...	...	...	...	...	...	...
Natural History	...	...	...	...	...	2	2	2	2	...	...	...
Writing	...	...	...	...	...	...	...	2	2	4	4	4
Drawing †	2		2		2	2	2	2	...	...	...	...
Singing ‡	5							2	2	1	1	...
Gymnastics	3	3	3	3	3	3	3	3	3	...	...	...

* Optional subjects. † Optional in I. and II.

‡ In the five hours for singing, IV.-I. are divided into four classes, according to voices and ability.

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* These names of the classes are often found marked on the plans of schools, as the size of the class is limited by its position.

There is very little difference as far as the Gymnasien are concerned between the different States. In the Southern States there is a tendency to give a rather larger proportion of time to Classics.

The *Pro-gymnasien* are the same as the above, but having the lower and middle divisions only, so making a six years' course. They are found, as a rule, in the smaller towns, where there are not enough boys who would stay to complete nine years' course. Such pupils are sent on to finish the last three years to some neighbouring town.

The aims of the *Realgymnasien* are the same as those of the Gymnasien :—To give the pupil a liberal education, but founded more on instruction in Modern Languages, Mathematics, and Natural Science ; so that while the class divisions and arrangements are the same, the curriculum is a good deal altered, English taking the place of Greek, while a great deal more time relatively is devoted to French and Natural Science.

CURRICULUM OF AN OBERREALSCHULE (from Vol. I. of the Special Reports).

SUBJECT.	NUMBER OF THE CLASS.									Total Number of Hours Weekly in the School, exclusive of Home Lessons.
	VI.	V.	IV.	III*b*.	III*a*.	II*b*.	II*a*.	I*b*.	I*a*.	
Religion	3	2	2	2	2	2	2	2	2	19
Mother Tongue, including Narration of National Events	{4, 1} 5	{3, 1} 4	4	3	3	3	4	4	4	34
French	6	6	6	6	6	5	4	4	4	47
English	...	...	...	5	4	4	4	4	4	25
History and Geography	2	2	{2, 2}	2, 2	2, 2	{2, 1}	3	3	3	28
Arithmetic and Mathematics	5	5	6	6	5	5	5	5	5	47
Natural History	2	2	2	2	2	2	...	...	...	12
Physics	...	...	...	...	2	2	3	3	3	13
Chemistry & Mineralogy	...	...	...	...	...	2	3	3	3	11
Writing	2	2	2	...	...	...	...	...	...	6
Freehand Drawing	...	2	2	2	2	2	2	2	2	16
Total of hours in each Class	25	25	28	30	30	30	30	30	30	258

The *Realschulen* are Higher Schools in which the Classical Languages are not taught, with six classes in the normal course. In

many cases, however, three extra classes are added, making the nine years' course complete. They are then known as *Oberrealschulen.* The object in view of these schools is to fit their pupils for effective and intelligent participation in the actual affairs of life. Particular stress is therefore placed on Modern Languages and Natural Science. The Prussian Ministry look with a very favourable eye on these schools, and try in every way to increase their number, even at the expense of the Realgymnasien, as it is to the pupils of these schools that the nation looks for its industrial leaders.

The *Höhere Bürgerschule* properly implies a High Grade Elementary School. The term, however, is rapidly falling into disuse, its place being taken by the Realschule.

GIRLS' SCHOOLS IN GERMANY.

Girls' Schools occupy in Germany a position very inferior both in position and in respect to State aid to that of the boys. As shown by Dr Wychgram,* there were in 1897, 586 Higher Schools for Boys, nearly half of which are supported by State aid, while there are but 128 Schools for Girls, of which four only receive any Government assistance, all the rest being supported by private means, or worked for profit, or managed by the city in which they are located. The reason of their relatively small importance probably is due to the lack of openings which would offer a career to educated women. Till recently the teachers in the Girls' Schools were men, so that there were no posts to be gained by a thorough course of study; there were no privileges attached to the Girls' Higher Schools, so that there was no object in uniformity of curriculum or methods; they do not want women at the University, so that here again there was no object in going through the course of studies of the Gymnasium.

However, in the last few years things have improved very much. The permission to teach in the Higher Girls' Schools was gained, and as candidates for teachers must pass a State examination, previous training of an adequate character became necessary. In 1894 a Ministerial Rescript was promulgated fixing the curriculum for the

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* Handbuch des Höheren Mädchenschulwesens, Wychgram, Leipzig, 1897.

Higher Schools for Girls (*Höhere Mädchenschulen*), also providing for the appointment of women to any position in the upper grades.

Pupils enter at six years, there being no Vorschule as for boys.

EDUCATION IN AMERICA.

There is in America the same widespread enthusiasm for educational subjects and the general public interest in it that is such a marked feature in Germany. The reasons for this are traced by Miss Burstall, in her book on American Girls' Schools,* partly to the democratic constitution of the country, which makes it so very necessary that those in whose hands so much power rests should be as far as may be fitted to make a good use of it; partly to the enormous foreign immigration, where the Public School, taking children of all classes, creeds, and nationalities, offers the best if not the only solution of the problem of how best to weld all this very mixed material into one homogeneous whole, to make a nation that shall to some extent have the same ideas and the same aims. Everywhere in books or papers on American education this feeling may be traced. English is enforced as the language in all schools, even in those where it is a foreign language to nearly all the children in the school, language being considered the great unifier. Private and Denominational Schools are not looked upon favourably, because they tend to strongly increase racial and class differences.

There is a singular degree of unity in American education, making it difficult to treat secondary and elementary education separately. Not only are they under the same authority, but they are very carefully arranged to lead from one to another—in fact, in America there is a complete ladder from the Elementary School to the University. Although the different States each manage their own educational affairs, there is not nearly so great a difference in their systems as one would expect to find—owing, perhaps, to the quickness with which new ideas are seized upon, and the completeness of intercommunications, due to the great number of teachers' societies and meetings, any scheme of education that seems successful in one State is very quickly adopted by others, anxious not to be behindhand in any improvements. "Not only is there a unity, there is an astonishing uniformity over the whole of the United States in organisation, methods, courses of study—

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* The Education of Girls in the United States, S. Burstall, 1894.

everything. Some districts and schools are of course better than others; some are permeated by a different spirit. But in outward form the uniformity over so large an area, with such absolute local freedom of variation, is extraordinary. The Educational Exhibit at Chicago showed this uniformity in a remarkable degree; the educational literature, reports, school laws, &c., show it also. It is perhaps not too much to say that there is less difference in form between the schools of Boston, Chicago, San Francisco, and Seattle, in the State of Washington, than there is between the different Girls' High Schools in London." *

The National Government in America has nothing to do with educational affairs, such matters being entirely under local control. Each State has its own school law derived from the State Constitution, which gives general direction. This is supplemented by Acts of State Legislation, in which are more detailed instructions, providing for the organisation of Local Boards, fixing the school age, particulars of compulsory education, &c. The School Boards manage the schools, levying the local rates, and erecting new buildings as required; arrange the curriculum, appoint teachers, and generally superintend the work of the schools. There is in addition a State Superintendent of Public Instruction, whose business it is to give advice, make reports, license teachers, &c. Schools are supported almost entirely by local taxation in the form of a property tax. There is, however, in addition a State fund, distributed by the authorities to equalise the burdens of taxation in providing for the poorer districts.

There is in America no system of inspections corresponding in the smallest degree to the organised inspection of Elementary Schools in this country, nor are there any great public examinations which can be taken by Secondary Schools, such as the Oxford and Cambridge Local Examinations, &c. The whole spirit of their education is, indeed, generally opposed to examinations, attempts having even been made to do away with the entrance examination to Universities, replacing them by a certificate to say that the pupil has been through such-and-such a course of study. This plan has not been adopted by such Colleges as Harvard and Yale.

The qualifications of teachers in the Public Schools are not governed by any general regulation. There is usually a preponderance of female teachers, due probably rather to the fact that they command a lower salary than to any theories on the subject.

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* The Education of Girls in the United States, S. Burstall.

The "Public," that is to say, the "Free" Schools, "Public" having that sense when applied to American Schools, are arranged in three grades by age. A Kindergarten is in some cases included in the first.

1. The Primary School—children of from six to nine years, learning Reading, Writing, Arithmetic, and the Elements of Language.

2. The Grammar School takes up the children as they leave the Primary School, keeping them if possible till the age of fourteen or fifteen, though of course many leave as soon as they are legally exempt in order to go to work. In the Grammar School, Grammar, Arithmetic, Geography, Literature, and United States History are taught. In the larger towns and cities there is a regular course of Manual Training included, and in some centres Natural Science. The higher classes of the Grammar School correspond to some extent to the English Higher Grade Elementary Schools or Third Grade Secondary Schools.

3. The High School takes its pupils at fourteen, fifteen, or sixteen years of age, to prepare them either for the University, or to finish their education by giving a broader knowledge and a more thorough training. This naturally tends to the establishment of two different sorts of schools. In Boston they are known as the English and the Latin, the latter being those which prepare pupils for the Universities. Attempts are being made to establish a third kind called Manual Training High Schools.

The point that at once catches the attention on looking at the organisation of schools in America is the fundamental difference between their idea of the connection between elementary and secondary education, and that prevalent in this country. The plan of classing schools according to the leaving age is thus quite impossible in America. All kinds of schools begin in the same way with the same subjects; the elements of knowledge are taught to all children alike, the only difference between lower and higher education being the point reached, the custom of beginning early certain subjects, such as Modern Languages and Latin, in the case of pupils who intend continuing their education till seventeen or eighteen, or are going to the Universities, being unusual in America, where the subjects are the same for all, whether they intend to go on or stop at fourteen. Of course this plan makes any scheme of progression from one school to another very much easier to arrange. Having completed the course at a Grammar School, a boy can either go on to a High School where he will find himself ready to go straight on with the work there, or he simply leaves school and goes to work,

and is supposed to have been equally prepared for either course. The difficulty found in the English Secondary Schools of classifying and grading the pupils coming with a scholarship from an Elementary School is thus done away with—that is to say, the American idea is that all children, whatever their future, should begin with the same education, adding something each year, but always putting what may be called the necessary subjects first, so that Modern Languages and the Classics are put off until the High School is reached. This scheme makes the educational unity so complete, and the educational ladder so easy, that it is still carefully adhered to, although it is of doubtful advantage from a purely educational point of view; languages, to be acquired in any degree of perfection, should probably be commenced at an early age. This common use of the Public Schools by all grades of society presupposes for its successful working an absence of social lines or demarcation of class such as is perhaps only to be found in America.

The most important personage in connection with education in America is undoubtedly the Superintendent. "Within his own domain, whether a State, a county, or a city, he combines in himself the characters of a Minister of Public Instruction, an Inspector of Schools, a Licenser of Teachers, and a Professor of Pedagogy."* His influence extends to every detail of school life. Serious breaches of discipline, cases of expulsion, &c., come through his hands; he acts as adviser to teachers on methods of teaching; gives hints to young and inexperienced students; and is the technical expert by whose opinion the Local School Board is to a great extent guided on very many points.

Before admission to a High School it is necessary to have a certificate from a Grammar School or to pass an equivalent examination. This of course simplifies to a great extent the curriculum, as certain subjects having been sufficiently studied, they are able to devote their energies to higher work.

The organisation of a High School is simple. The pupils are arranged in years, admission being only allowed once a year in September, unless the applicant can produce satisfactory evidence of being able to take up the work at the proper point. At the end of the year they all go regularly on to the next year's work. Any who are too backward to do so either go over the year's work again, or perhaps more usually leave the school. At the end of the course of three or four years a diploma is given, but not as the result of any examination. There are, as a rule, in the High Schools several courses

* Notes on American Schools and Training Colleges, p. 61, Sir J. Fitch.

of study, one of which is chosen by the pupil on entering. There is the college course of four years; the English course mentioned above; then there is a commercial course of two years. In some cities there is a three years' course of engineering.

The word "class" does not convey the idea of a form in the English sense, but means all the students of one year, which may in a large school amount to 200 or more. These classes are divided up according to the different subjects taken by the pupils. In many cases, of course, these divisions are too large to be taken at once. They are then divided into sections, the teacher repeating the lesson. There is no system of grades or classification according to attainments, the whole "year" or "class" being kept parallel, although taught in sections. Thus there is never found at the top of the school a small form, such as the English "sixth," doing advanced work in different subjects.

The daily work in an American Public High School is confined to the morning, as a rule from 9 till 1.30. There is a "recess" or period of rest in the middle of the morning of about half an hour, when the pupils have a light lunch, either bringing it themselves or buying what they want at the school, a few who live close by returning to their homes.

There is a great variation as regards the custom of a general assembly in the morning before work. Any daily religious ceremony is unusual, but in some schools it takes place two or three times a week, or else the school is called together for some form of literary exercise. The morning is divided into five periods, one of which is given to private study—that is to say, while the lessons are going on, the pupils who attend the subjects of them are in attendance, while the others, sitting at their own desks in special study-halls, go on doing work by themselves. It is necessary to bear this in mind when looking at the plans of American schools, as it explains the large schoolrooms, the size of which is apt to strike any one who sees the drawings for the first time. The actual teaching is done, for the most part, in smaller rooms, which are called "recitation rooms," and which correspond more to our class-rooms. At the close of each lesson period electric bells sound all over the building, and a few minutes, three to five, are allowed for the change of class-rooms. During this period conversation is allowed. Since the foregoing remarks apply as well to girls as to boys, there is no need to go into the subject of girls' education separately, as most of the schools are co-educational, educating the boys and girls together, and even where there are separated schools,

the subjects taught and the organisation of the school are so nearly identical as to make a separate account unnecessary.

There are in America, though to nothing like the extent in England, Private Secondary Schools, and under the term private are included schools governed by a Board, though not conducted for private profit—in fact, all schools that are not free. These schools are not numerous. They are conducted very much on the lines of the Public Schools, but are not subject to any inspections or regulations.

Chapter V.

SECONDARY DAY SCHOOL BUILDINGS.

Method of dealing with the Buildings in the following chapter—Æsthetic Considerations in the Treatment of the Interior of Secondary School Buildings—**Sites** and the questions which govern Position—**Aspect**—Advantage of plenty of Sun—Relative Merits of the different Points of the Compass—North and North-west, West and South-west, East and South-east, North-east—**Accommodation,** Extent required—Questions which determine the number of Class-rooms required—Necessity for Division Rooms—Sliding Partitions—List of the Accommodation required for a Large School for Boys—Similar List for a German School of the same kind—Differences—Girls' Day Schools: List of Rooms required—Consideration of which Rooms can be dispensed with, and how Retrenchment can be most conveniently made—List of the Minimum Accommodation.

In dealing with the subject of school buildings, the following arrangement has been adopted:—First of all, to give some consideration to questions affecting school planning generally; and then, before proceeding to describe and illustrate examples of different schools in detail, to enter as carefully as possible into the questions of the extent of the accommodation required, the uses and purposes of the different rooms, and the form, dimensions, and position that have been found best adapted to serve those purposes. The object of this is to make the plans given later more intelligible, since the plan of the whole school can scarcely be understood, or at all events appreciated, without a clear idea of the purposes which the various parts of it are intended to serve.

There is, as a rule, in regard to the interior fitting and arrangement of Secondary Schools, too little attention paid to their æsthetic qualities. Schools are apt to have, to a quite unnecessary degree, the bare unattractive appearance usually associated with institutions. Although much can of course be done by means of pictures, engravings, &c., it is impossible in many cases to do much to relieve the monotony. The effect is often increased by having all the paint-work in the building a dull and dreary brown, while each class-room is an exact counterpart of every other. In recent years a great deal more attention has been paid to these questions,

a notable example being the new school for girls at Roedean,* which is not only spacious and healthy, but attractively and artistically treated. There is still, however, a good deal that might be done in this direction. It often looks as though much of this lack of the amenities of a building were due to the habit of freely adopting in Secondary Schools, fittings, methods, and styles of building which have been found successful in the Elementary Schools, but which, though well enough adapted for them, are unnecessarily institutional and formal for a Secondary School. The modern Board School, with its clean and excellent, if somewhat bare, building, offers a quite sufficient contrast to the homes from which most of the children come, and is therefore perhaps quite as well adapted to give them a start on the road to a higher standard of living as would a building more elaborately treated. But to children, and especially to girls accustomed to the refinements of a cultivated home, the buildings of such a school are more likely to present a forlorn and forbidding appearance than to have any elevating tendency. Although it may and indeed does cost more to make a handsome interior, there should surely be set against this the fact that refined and artistic surroundings have a high educational value. So much is spent at the present time on teaching art directly, that some allowance might be made for influences of this kind, which are none the less strong because imbibed unconsciously. A careful scheme of colour decoration alone will do much to add to the appearance of a school without increasing the cost materially, while treating each class-room separately not only affords a welcome change to the eyes of the pupils when moving from one room to another, but gives a pleasant individuality to each room. There is the incidental advantage that it makes it easy to do up one or two rooms without doing up the whole building.

SITES.

The best site for a school is naturally that of the best site for any kind of house—that is to say, the most healthy position would be the top of a hill facing south, with a gravel, sand, or chalk soil, sheltered to the north and east by trees, preferably pines ; while the worst situations are those close to the bed of a river, or on low-lying clay soil. It should be remembered too that some situations, though apparently healthy, with a good soil, such as sand or gravel, yet owing to a subsoil of clay under the gravel, are nearly as unhealthy, owing to the impervious layer

* Described and illustrated below (see Fig. 190).

below, as though standing water showed actually on the surface. While books on school building generally give very careful and elaborate directions as to soil, site, aspect, &c., on which the building should be placed, it usually happens that the final position of the school is governed by very different considerations, especially in the case of Day Schools, which, to fulfil their purpose adequately, must be placed in easily accessible situations, close to large centres of population, and where the necessary space can be secured. In the case of non-local Boarding Schools, since they have not to study the convenience of day pupils, it is of course generally possible to pay due consideration to these sanitary questions. Naturally, too, they assume greater importance in the case of Boarding Schools.

The most important desiderata for the school building are good air, plenty of light, and freedom from the disturbance of noise, caused by traffic, factories, &c. To secure the first, the building should stand on high ground, and as far as possible from neighbouring houses. In this respect regard should be had to the likelihood of future building operations in the neighbourhood. Low-lying ground, or places ever liable to flood, are particularly to be avoided, for though by careful precautions the building itself may be kept dry, the playground will in wet weather have water frequently standing upon it, and be a cause of continual nuisance, and a source of ill-health.

Trees and shrubs, especially evergreens, planted so as to act as a protection against the cold winds, are an advantage, especially in the playground; but of course care must be taken that they do not in any way interfere with the lighting of the school.

In a town the school should be placed in as quiet and wide a street as possible. The noise from the street is very much less when the houses on the opposite side are low, while the light also is of course much better. It is worth remembering that if there is a narrow passage down the side of the school building, formed by a high house or a wall, the noise from the street will be caught and re-echoed very strongly into the class-rooms looking into any such passage. Any precautions taken, such as double windows, to exclude the noise to the front of the building, should also be taken for these windows, as it often happens that the noise thus arising from this confined area is actually more disturbing than that coming through the windows looking directly on to the main street. The school should of course be put back as far as possible from the street to avoid the dust as well as the noise. When, as is sometimes the case, the school is brought up to the street level to make an imposing appearance, or to draw attention, the class-rooms

looking out over the street should have double windows, though this precaution is of little use in hot weather, unless some complete scheme of mechanical ventilation has been installed. As far as possible the building should be planned so that the corridors and rooms where noise is of not quite so much consequence, as for instance, studios and laboratories, or the school hall, should come on the street side. The strain upon the voice of a teacher in a class-room looking over a street is very great, and is likely to result in injury to the throat.

In the position of a school it is well that the approach to it should be carefully considered, *i.e.*, with regard to shops, mews, public-houses, or factories that the pupils will have to pass. This naturally is of great importance in the case of Girls' Schools. The neighbourhood of big factories is also to be specially avoided, owing to the dust and possible fumes.

With houses opposite there should be a sufficient distance to make sure that the light will not in any way be interfered with.* Rooms that are darkened and shut in by neighbouring buildings have a most depressing influence on those who have to occupy them, and are particularly to be avoided in school buildings.

If the school is on high ground, care should be taken that the approach should not be too steep, as in winter, during frosty weather, there are likely to be accidents, especially among the smaller children.

ASPECT.

The point towards which the school should face should of course be determined by the positions of the class-rooms, whether placed in the front or the back of the building, in order to obtain the most suitable aspect for their windows.

During school-time it is essential that every class-room should have an abundant supply of light, so that the class-room window should face towards the quarter whence is derived the best supply of light during the hours which they are in use. Further, it is essential, for the sake of the health of the scholars, that sunlight should have direct access to every room, at least during some part of the day, though it is sometimes argued, especially by German authorities, that it is advantageous if this can happen while the class-room is not actually in use; and while this may be important in countries where the sun has during the

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* For this see on lighting of class-rooms, where the question of opposite houses is treated at length.

summer much more power than in this country, it is seldom that much discomfort is felt here, except in the case of class-rooms facing due west, in the afternoon in summer.

The old Italian proverb, "Dove non va il sole, va il medico," is nowhere of greater truth than when applied to school-rooms, and the reasonableness of the old saying, that no room is healthy where the sun does not come, has been well proved by the recent researches and investigations made by bacteriologists on the effect of direct sun rays on bacteria and disease germs of all kinds, for when subjected to strong sunlight it is found that the bacteria of nearly all diseases rapidly weaken and die, so that the disinfecting power of the sun is one of which the fullest use should be made in the arrangement of the school building.

The sun in the early morning and late afternoon, being then lower in the sky, will naturally shine much farther into the rooms than during the middle of the day. It is of course hardly possible to arrange that every class-room in a large building should have an equally good aspect; but as far as can be managed, it should be arranged that none of the regular class-rooms should face the north only, except in the case of the studio, for which, as it requires a steady light, a northern aspect is best. The days when there is likely to be too much heat are in this country not very many, and a proper arrangement of blinds will make the management of the light easy. The hottest time of the year too falls usually in the summer holidays. The advantages of the sun are so great from the point of view of health, that they should outweigh a small amount of possible discomfort on a few days of the year.

The relative advantages of the different points of the compass may be shortly considered.

The North and North-west.—These aspects should never be used for class-rooms, as they get practically no sun until late in the day. If it is necessary that any rooms should have this aspect, these should be those which are occupied seldom, or for a short time only, and this side of the building may be taken up by the windows of the hall, studio, chemical laboratories, waiting-rooms, committee-rooms, staircases, or corridors.

West and South-west.—These aspects have an advantage in cases where it is preferred to have the direct sunlight into the class-rooms at a time when the rooms are not being used, since it is not till the afternoon that the sun will come into such rooms, and so in High Schools and others in which class-room work is as a rule confined to

the morning, the sun will only come into the rooms after the hours of regular work. These rooms, however, in schools where work is done in the afternoon, will get hot in summer, while missing the early sun in winter.

East and South-east.—Rooms looking to these points get the best light all the morning hours. The sun shines into the room in the morning, making the rooms cheerful and comfortable in the cold weather, while in summer the sun is off before the hot part of the day. The early sun, too, has not the same power in the morning as later in the day when everything has been heated. In the rooms looking due east the level rays of the early sun, except in midsummer, shine right into all the farthest corners of the room. For small children, kindergartens especially, this aspect is very valuable. On the whole, perhaps the best aspect a school can have is that from east to south-east.

North-east and East.—For schools where teaching is carried on both morning and afternoon, Dr Baginsky,* writing of German Schools, recommends north-east to east. In such rooms the sun is off soon in the morning, and in the late hours will only shine a very short way into the room.

It is always as well, especially in arranging the exits and entrances of a school building, to take careful note of the prevailing wind in the locality, so that the door should be screened from it.

ACCOMMODATION.

It is now proposed to consider the amount and the nature of the accommodation that should be provided in a Secondary Day School; the size and the number of the different rooms, and the purposes they are intended to serve. The question of the extent of the class-room accommodation that ought to be provided for a school, the number of whose pupils has been already settled, is one to which as a rule too little attention is given. A Building Committee is apt to consider the question well disposed of when sufficient class-rooms have been provided to allow a seat for every scholar in the school, say ten class-rooms capable of holding 30 for a school of 300; and would be not unlikely to consider a Head Master or Mistress unreasonable, if with perhaps 250 pupils, they began to complain of want of room, and to ask for more class-rooms. This is a point

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* Schulhygiene, p. 51.

upon which misunderstandings often arise between governing bodies and heads of schools. The number which the building will accommodate is given by the architect on the assumption of each class-room being filled, whilst the Headmaster with a considerably less number often finds himself much pressed for room. It may be worth while to consider briefly the cause of this difference, for the reason, though obvious enough, is very often overlooked. The class-rooms are as a rule built of one or two sizes, to take forms of say 30 or 40, with perhaps one or two capable of taking a larger number. It then happens that one or two small forms, such as the sixth, which even in a large school may perhaps not consist of more than 12 or 16 members, has to occupy a room capable of accommodating say 30. But it is in the middle of the school, where the largest forms are found, that the difficulties chiefly occur. It frequently becomes necessary to divide some form that is becoming of an unwieldy size, owing to promotion from the forms below being more rapid than usual, or slower into the upper forms, into two parallel divisions. This necessitates the use of an extra class-room, so that while the total number of the school remains practically unchanged, an extra class has been added by the depletion of forms below, which, though not up to their full strength, still require their own separate class-rooms. Unless there are sufficient rooms to allow for this, there arises a tendency to grade the pupils by the size of the class-rooms instead of by their attainments. It may easily happen in a school of the size mentioned above, viz., ten class-rooms capable of holding 30, that there are ten forms, each requiring their class-rooms, varying from 16 or 18 to 25; better of course from an educational point of view, but it is not always easy to satisfy a School Management Committee that a building nominally capable of holding 300 can hardly be worked comfortably when there are not many more than 200 pupils in the school. Again, the system of splitting up a form into two or more divisions for certain subjects that require more individual teaching necessitates the provision of a certain number of division rooms. These are in addition to the regular class-room accommodation, and should not be counted in reckoning the capacity of the school.

Difficulties of this kind are naturally far more marked in the case of a building that is not of recent erection, for it was formerly customary to provide rooms for much larger classes than would be considered right at the present day, the tendency now being very strongly in the direction of small classes. For instance, at St Paul's,

West Kensington, built some eighteen years ago, the class-rooms are all capable of accommodating 40 boys. This school is, however, very highly staffed, and the average number in a class at the present time does not reach 20. That is to say, since the rooms themselves cannot be divided, the actual accommodation of the school is at least halved. The question of the number of class-rooms to be allowed is usually approached simply from the point of view of the number of pupils to be provided for, instead of the number of classes it is intended to have. In Germany, where the number of classes in schools of similar kinds is always the same, the only question to be settled is that of how many it will be necessary to divide into parallel forms. There are no questions of such division or reclassification to consider; nor is there a small form at the top of the school, as our sixth form, standing on any different footing to the rest of the school, to be provided for. There is, however, almost invariably one spare class-room provided for each department of the school, to allow of any form which grows too large being divided into two parallel forms.

In this country, where the Secondary Schools present so many and such great differences in their organisation, it would be hardly possible to consider the question in this way, except perhaps in the case of the rebuilding of an existing school where the Headmaster can say what rooms will be required. It is hardly possible to overrate the advantage to the architect of having the Head Master or Mistress to give his or her advice as to what rooms will be required while the plan of the building is under consideration.

In the case of a new school too, when possible, the plan of appointing the Headmaster before the school is built will generally result in a building better adapted to the needs of the school.

In addition to the regular class-rooms for the form work, as mentioned above, the number of division rooms usually required will be one or two, according to the size of the school, for each of the three ordinary departments, viz., upper, lower, and middle; but a few extra small rooms for the upper school will generally be found a great convenience to provide for small classes preparing for special examinations.

The plan of having two adjacent class-rooms separated by a sliding partition that enables them to be thrown together easily, though never found in German Schools, is often found to be of great use, so much so that it is usually recommended that there should be two so arranged on each floor, to meet the case of the temporary illness or absence of a master, or when it may be necessary

to throw two forms together for the purposes of examinations, or for the purpose of a collective lesson or lecture.

In the case of a new and inexperienced master or mistress it is sometimes expedient to put an older and stronger teacher next door, to give assistance if necessary.

Below is given a list of the accommodation that it is suggested should be provided in a large Secondary Day School for Boys organised on the usual plan of an upper, lower, and middle department. The sizes and use of the different rooms are discussed later.

1. Large assembly hall.
2. Class-rooms for every form in the school—or say, to allow of variation in size, four class-rooms to hold 30 for every 100 boys.
3. One reserve class-room in each department.
4. Two or more division rooms to hold 15 to 20 in each department.
5. Sixth form room (where this is provided one class-room can be omitted).
6. Headmaster's class-room.
7. Chemical laboratory and store-room.
8. Physical laboratory and store-room.
9. Balance-room.
10. Dark room for optical experiments.
11. Room for Botany, Biology, and microscope work.

11A. Natural Science Master's room.

12. Museum.
13. Studio, small room for models, drawing-boards, &c.
14. Drawing-school for mechanical drawing.
15. Library for pupils.
16. Library for masters.

16A. Quiet room for cases of illness.

17. Assistant masters' common room, with separate lavatories and cloak-rooms.
18. Headmaster's room, with lavatory.
19. Secretary's office.
20. Clerk's offices, including stationery and book store.
21. Porter's office.
22. Waiting-room for visitors.
23. Committee or Board room, often combined with and serving for Secretary's room.
24. Dining-room, with kitchen, larder, scullery, serving-room, &c.
25. Cloak-rooms, lockers, &c.
26. Service-rooms on each floor for cleaning purposes.
27. Lavatory basins, say 7 per 100.
28. Closets, say 3 per 100.
29. Urinals, say 6 per 100.
30. Gymnasium and dressing-room.
31. Covered playground or playroom.
32. Playground.
33. Fives courts, tennis courts, and playing fields.
34. Storage room for games, &c.
35. Heating chamber and coal storage.
36. Drying-room for wet clothes.
37. Bicycle shed.
38. Porter's or caretaker's living rooms.

Such things as swimming baths, carpenters' shops, and various rooms for manual instruction and recreation, are added according to the objects in view and resources of the school.

It is not suggested that all these rooms are absolutely necessary, but in a large modern school nearly all of them will be found. It may be of interest to compare with the above list the rooms that would be considered necessary in a German School of a corresponding type—that is to say, a Gymnasium and a "Real" Gymnasium combined. It is necessary to put the two together for comparison, in order to make it equal to the Classical and Modern Sides of our Secondary Schools. First as to the class-rooms required, it is here that the main difference is to be found. There are no division rooms required. The classes are as a rule, especially in the middle forms, rather larger. By the Government regulations, the maximum size of classes in German Schools vary according to the department of the school—that is, in the upper department 30 is usually the maximum size, 40 in the middle, and 50 in the lower. As an example, in the St Maria Magdalene Gymnasium * at Breslau there are about 450 boys. Of the nine regular classes, seven, that is to say, all except the two highest, are split into two parallel divisions, making sixteen classes in all, varying in number from 20 to 25 in the top forms to over 40 in the middle of the school. A Gymnasium of the ordinary type, having a nine years' course, must have nine classes, whatever the size of the school, but may have more, as it becomes necessary, owing to an increase in numbers, to split any form up into parallel divisions. The following list is taken from the "Handbuch der Architektur," vol. iv. :—

1. A hall.
2. 9 class-rooms,† 3 for 30, 3 for 40, 3 for 50, with one reserve room in each department at least.
3. Room for the Natural History collection (Museum).
4. A class-room for Natural Science teaching and store-room.
5. Preparation room for Natural Science teacher.
6. Drawing-school.
7. Singing-school.
8. Headmaster's or Director's office and clerk's office.
9. Waiting-room for visitors.
10. Assistant teachers' room, with lavatory.
11. Consultation or conference room, sometimes serving the purpose of the assistant teachers' room.
12. Service room, for cleaning, &c.
13. Cloak-rooms.
14. Lavatories.
15. Closets.
16. Urinals.
17. Gymnasium and store-room.
18. Playground.
19. Servants' living rooms.
20. Sometimes Headmaster's living rooms.
21. ‡Lecture-room for Chemistry, with preparation room.
22. ‡Chemical laboratory and store-room.
23. ‡Room for mechanical drawing, store-room for models, boards, &c.

* Taken from the Annual Report.

† As many more as may be required by the numbers in the school necessitating division into parallel forms.

‡ Extra in a Realgymnasium.

There is not a great deal of difference in the rooms required in the schools of the two countries. No provision is made for dinner in the middle of the day in German Schools, and such rooms as carpenters' shops and manual training rooms are found in the Technical Schools. They have as a rule a large room devoted to instruction in singing, which is not often found in an English School. German Schools of all grades invariably have a large and well-equipped gymnasium.

Girls' Schools.—As regards the extent of the accommodation that should be provided for a Girls' School, while it is on the whole much the same as that for boys, it has been thought that it would be convenient to give a complete list. It often happens, unfortunately, that the resources available for building schools for girls are, for various reasons, not as large as in the case of a Boys' School. For instance, in the rearrangement of an endowment or a charity, provision is often made for the establishment of a Girls' School; but as the trust was not intended primarily for girls, their school is apt to come off second best as regards money. The result of this is that the question of accommodation turns rather on which of the rooms are to be considered indispensable than on those that might be considered desirable. For this purpose, in the following list, the rooms that are not absolutely indispensable are marked with an asterisk, and the considerations on which they can be omitted are treated afterwards. These remarks are of course to a large extent equally applicable to Boys' Schools. There are no very great differences observable between Girls' and Boys' Schools. There is perhaps in the latter more attempt to make the rooms cheerful and homelike with pictures, flowers, china, &c. Girls' Schools have very commonly a Kindergarten or Preparatory Department attached, which of course involves a certain number of extra rooms. It is also possible to keep the school cleaner, and to have polished floors with all their advantages, owing to the custom in Girls' Schools of not wearing outdoor boots inside the building.

1. Assembly hall.
2. Class-rooms, 4 to every 100.
3. A reserve class-room or two.
4. Two division-rooms to every 100.
5. Chemical laboratory and * store-room.
6. Physical laboratory and * store-room.
7. Balance-room.
8. *Dark room for optical experiments.
9. *Room for Botany, Biology, and microscope work.

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* Asterisks are placed against the rooms that cannot be considered absolutely indispensable.

9A.*Room for Head Science Mistress.

10.*Sixth form room or class-room.

11. Studio, room for models and boards.

12. Cookery instruction room, if required by curriculum.

13.*Library for pupils' use as well as mistresses'.

14.*Lecture-room for Natural Science, with preparation room.

15.*Museum.

16. Kindergarten room, with separate cloak-rooms and lavatories.

17. Transition form room, next the Kindergarten.

18. Two rooms for teaching piano for every 100 girls.

19.*Room for teaching singing.

20. Assistant mistresses' room, with cloak-rooms and lavatory adjoining.

21. Headmistress's room and lavatory.

*Waiting-room for visitors.

Secretary's office.

22. Book and stationery store.

23. Cloak-rooms for school above the Kindergarten.

24. Lavatories, 7 per 100.

25. Closets, 5 per 100.

26. Dining-hall—kitchen, larder, scullery, &c.

27.*Gymnasium and dressing-room.

28.*Covered playground or playroom.

29. Playground — tennis and fives courts, if possible.

30. Bicycle shed.

31. Servants' accommodation.

32. Heating-room and coal store.

33.*Drying-room for wet clothes.

34. Storage room for chairs, games, &c.

35.*Provision for examiners and inspectors.

36. A student-teachers' room, if required.

37.*Board or Committee room, with lavatory.

38.*A quiet room for cases of illness.

39.*A bath-room.

40. Service-rooms for cleaning purposes, with hot and cold water, on each floor.

41. Lift for coals if open fires are used.

42. Some convenient arrangement for the mid-morning lunch.

This accommodation can of course be considerably curtailed without seriously impairing the efficiency of the school, and as mentioned above, the question which most usually arises is rather what rooms it is impossible to do without rather than what rooms it would be an advantage to have. It is proposed to consider how far it is possible to reduce the list. And while on the subject of cutting down, a painful and distressing business, but one which from financial reasons plays usually so large a part in the preliminaries of a building scheme, it may perhaps be permissible to lay stress on the fact that cheapness and economy are by no means synonymous terms, an obvious truism

* Asterisks are placed against the rooms that cannot be considered absolutely indispensable.

enough, but one very apt to be ignored in the effort to reduce the cost of the scheme down to some particular figure. In no class of building perhaps does cheap or scamped work make itself sooner or more annoyingly felt than in a school, owing to the great wear and tear to which it is subjected. The last few hundred pounds is very often squeezed off at the cost of a considerably greater outlay afterwards on small repairs and additions.

It is now proposed to suggest how the rooms in the above list marked with an asterisk can be dispensed with. First of all, the accommodation given for Natural Science is on rather a large scale, and would be only found in a school which made rather a specialty of the subject, preparing candidates for Natural Science scholarships, &c. But two rooms, one for physical and one for chemical work, must be provided. The attempt to use one laboratory for the two subjects results at once in the destruction of the physical apparatus, from the fumes given off in the chemical experiments. Although it is a great advantage in a school of any size to have a room for the Science Mistress, as she is the head of a department of the school, it cannot of course be considered an absolute necessity. The library and lecture-room, useful and advantageous as they are, will probably be omitted when there is great pressure on space. The library is used by the elder pupils to work in at certain times by themselves, in order to learn how to use books of reference, &c., and is becoming more and more considered a necessary part of a properly equipped educational institution. It is hardly ever absent from a German School.

The lecture-room cannot be considered indispensable, but should if possible always find a place. It is often possible to combine the lecture-room and library in one, and also make the same room serve for the student-teachers' room, should there be any attached to the school.

The museum may well be considered a luxury which can be cut off without much loss. Cases can be stood in the corridors or anywhere where there is room to accommodate any collections that the school may happen to possess.

It is sometimes suggested that a studio can be dispensed with, on the ground that two large class-rooms capable of being thrown into one will serve for the purpose. In the conditions of a recent competition for a Girls' School, a double class-room was allowed in the accommodation as an alternative to a studio. It is only as a last resort, I think, that this should be permitted. To begin with, the use of class-rooms which presumably have their proper forms must lead to considerable

disorganisation in the school arrangements. It does not at all follow that a well-lit class-room will make a well-lit studio—in fact, just the reverse of this is more likely to be correct. The difficulty, too, of disposing of all the stands, easels, models, and drawing boards, with the consequent loss of time, make a compromise of this sort very undesirable. As long as drawing was more or less an extra subject, taken perhaps in the afternoon, these objections were less felt. Now that it is a regular class subject, a studio may fairly be considered necessary.

Another plan of making one room serve two purposes, for the sake of saving space, is managed by so placing the Kindergarten-room that it can also be made to answer the purpose of a dining-room. As the Kindergarten goes on in the morning only, and is over by half-past twelve, it is possible to manage to have the room ready for lunch by one o'clock. The room must of course be near the kitchen, and have the tables arranged with trestles, so that they may be easily removable, some handy place of storage for them being provided. The arrangement, though by no means an ideal one, is a considerable saving of space, and if well arranged can just be made to work.* The need of a gymnasium can be met by placing the gymnastic apparatus in the assembly hall. It is necessary in this case to guard against the production of too much dust, but provided that there is a polished floor, and that no exercises requiring the use of mats or mattresses are indulged in, little objection will be found. Complaints, however, are sometimes made on æsthetic grounds, perhaps not unjustifiably, that it spoils the appearance of the hall.

The class-room accommodation is the last thing that should be touched. The inconveniences arising from the lack of room here are serious, very prejudicial to the work of the school, and even to health. Small subdivisions have to be taken in any corner where they can find a resting-place, at one end of the hall, or the end of a corridor. I have even seen cases of a division eventually finding a haven of refuge in one of the cloak-rooms. Under these circumstances the class-rooms are never vacant ; there is no time during which they can be ventilated ; classes and divisions have to be continually driven about, with no regular place for work, and the strain becomes too much for the most long-suffering Headmistress and staff.

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* It should be remembered that if there are students in training in the Kindergarten, the room will be again wanted in the afternoon ; in this case such an arrangement is very undesirable.

The following list of accommodation is given as what may be considered an irreducible minimum :—

- Assembly hall, fitted with gymnastic apparatus.
- One class-room for every 25 girls.
- One division-room for every 100 girls.
- Chemical laboratory.
- Physical laboratory.
- Studio.
- One music-room for every 100 girls.
- Assistant mistresses' room and lavatory.
- Headmistress's room and lavatory.
- Secretary's room, serving also for waiting-room and book store.
- Cloak-rooms, lavatories, &c.
- Kindergarten-room, serving also for dining-room, and placed close to necessary kitchens, sculleries, &c.
- Heating - room, coal cellars, &c.
- Service-rooms.
- Lift.
- Bicycle shed.

It is no doubt possible to work a school with even less accommodation, but the above list may be taken as giving the rooms which any school pretending to carry on its work efficiently ought to have. The standard of requirements for school buildings has risen so much during the last few years, while unfortunately the cost of building has gone up no less quickly, that governing bodies find it difficult to keep their schools abreast of the times. In addition to the increase of accommodation required in the building, there is also a similar tendency to increased expense in educational matters, very much larger staffs of teachers are required and with larger salaries; while at the same time the fees charged to the pupils have remained the same, or have been increased to a very small extent. Schools with a valuable endowment, and those belonging to rich City Companies, or those, such as the Higher Grade Schools, which can fall back on some reserve of public money, are able to meet the additional expenses, and set a standard to which it is difficult for those dependent on the fees they receive to attain.

Chapter VI.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

Details of the various Rooms, &c.—**The Hall**—Size, Lighting, Position, Exits, and Entrances—Expedients for gaining Space in Hall—**Staircases**—Their Position, Form, and General Arrangement—Emergency Stairs—Box and Open Staircases—Width required—Height of Risers in Germany and America—Material for Treads—Handrails—**Corridors**—Width required—Uses of a Wide Corridor—Lockers placed in—Material for Flooring—**Entrances** to the School Building—Pupils' Entrances—Porch for waiting in—Supervision—Tradesmen's Entrances.

THE HALL, OR ASSEMBLY ROOM.

The hall should be amply large enough to seat all the pupils in the school, with a margin in case of increase in the numbers. As a rule there is required considerably more room than is actually taken up by the school, as in the case of prize-givings and entertainments it is usual to ask parents and friends. It is, however, open to question as to how far it is a good plan to make any allowance for functions which occur only a few times in the year, when there is probably a Town Hall or some convenient place that can be hired for the purpose. This has the additional advantage of connecting the school with the neighbourhood, and of increasing the local interest in it. In cases where there is any want of money, it is probably better to limit the size of the hall to the actual requirements of the school, in order that the saving should not be at the expense of the class-rooms.

It is not very easy to find any data on which to base a calculation of the amount of floor space that should be allowed per pupil in the hall; there is so large a variation in different schools, the measurements of the hall depending to a large extent on the resources available, and the type of building adopted, and the purposes for which it will be used. For example, in the school for boys recently erected in Holborn by the Mercers' Company, there is a handsome and well-decorated hall, measuring 70 by 40 ft., with an arcade

on one side leading to the class-rooms. The school is intended to accommodate 300 pupils, so that this gives an allowance of 9 sq. ft. per head, an unusually large allowance. In the King Edward VI. School for Girls in Birmingham, another recently built school on a very liberal scale, the hall measures 68 by 31 ft., which, the number of the school is intended for being 350, gives about 6 sq. ft. per head.

The new buildings for the Grammar School at Bedford, having a class-room accommodation for over 1,000 boys, provide a hall measuring 102 by 50 ft., which, including the platform, gives an allowance of 5 sq. ft. ; but as there are in addition two large galleries, there is sitting-room for a large number. Indeed, on a recent occasion, an audience of over 2,000 was able to find room.

In the schools of the Girls' Public Day School Company it has been found that an allowance of about 5 sq. ft. will give sufficient room including the platform. On the whole, therefore, while an allowance of 6 sq. ft. per pupil will probably give ample room, any further space that can be given will prove of great advantage ; and especially the hall should be made as large as possible, if there is any reason to suppose that the school will at any future time be enlarged, for while it is generally easy to add on class-rooms, it is rarely possible to increase the size of the hall. Various devices have been tried from time to time for the purpose of increasing the size of the hall when required for special occasions by making the class-rooms next the hall with partitions that are easily removable. For an example, see Fig. 166, in which it is possible to throw practically all the class-room space into the hall. Two class-rooms are sometimes placed at the end of the hall opposite the platform, separated from it by rolling or movable shutters. The latter leaves a pier in the middle when the rooms are thrown into the hall. Additional seating accommodation can often be gained by placing a large room, such as a studio on the first floor, so arranged that it can be used as a gallery to the hall. See Fig. 73, where this has been done. Expedients of this nature are, however, in Secondary Schools of doubtful advantage. The disturbance caused by noise, against which partitions are rarely proof, if capable of being moved, is hardly compensated for by the very occasional use made of such an arrangement.

In schools that are sufficiently provided with rooms to obviate the necessity of using the hall for drill or gymnastics, or for any purpose beyond that of assembling the whole school, it is usual to find it fitted with benches or chairs. But in schools that are not so well off, the floor has to be left clear, and provision must be made for the storage of the chairs which would then only be used occasionally, the pupils

standing for daily prayers, &c. The space under the platform is commonly utilised for this purpose, but this, unless of unusual size, is not sufficient, and further room must be provided. The more common plan under the latter circumstances, however, is to hire the chairs when required.

It is of course as well to ascertain whether the hall is to serve as a gymnasium, so that the necessary constructional arrangements may be made for suspending the various kinds of apparatus.

When the plan of the building will allow, there is little doubt that side lighting is preferable, as it makes the questions of heating and ventilation easier. Great care has to be used in estimating the amount of glass required when halls are lit from the top, and considerable judgment to prevent shadows being cast by balconies or galleries. "Centre top lights are rarely successful for school-rooms of any kind. . . . In fact, one has to be very careful indeed to avoid having too much lighting surface, which, it must never be forgotten, is also chilling surface in cold weather and heating surface in summer-time." *

The question of the position of the hall in reference to the class-rooms is discussed more fully in the chapter on planning, but whatever the type of plan that may be adopted, there are certain points in regard to the position and arrangement of exits and entrances to the hall that should be carefully borne in mind. It should of course be within easy reach from the class-rooms ; it should also be easily accessible from the front entrance of the school, as in case of entertainments, lectures, or prize-givings which take place in the school hall, it is a great convenience that there should be a simple and direct way from the front entrance to the hall, and one which is separate from that used by the school, in order to avoid the crowding that would be caused by visitors and pupils all leaving by the same exit. It is further necessary that there should be an entrance close to the platform, so that the Governors of the school or prominent persons who are to distribute prizes or occupy seats on the platform should not have to squeeze their way right up the hall, which on such occasions is usually filled to its utmost capacity. An entrance at the back of platform from a small ante-room or class-room is found a great convenience ; when, as often happens, some form of dramatic entertainment is taking place, it can serve as a green room (see Fig. 117).

Sometimes it is found convenient to have at the end of the hall

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* The Planning of Secondary Schools. Paper read to A.A., 11th December 1897, by J. Osborne Smith.

opposite the platform three or four rows of seats raised from the floor. This makes it easier to see the platform, and although it detracts from the free floor space, it serves very well for singing classes, for which in Germany it is usual to find a special singing hall, not usually provided in English Schools.

There should, under all circumstances, if the school contains above 150 pupils, be at least two main exits from the hall leading directly to different staircases, so that the room can be at once cleared without danger of crushing in case of panic.

The part which the hall plays in the whole course of the management of a school is so important, especially, as remarked above, in those schools not sufficiently equipped to have special rooms for every purpose, that it is impossible to exercise too much care in its planning and arrangement.

STAIRCASES.

In schools where there are both girls and boys, it is necessary to supply a separate staircase for each sex. Staircases should be thoroughly and efficiently lighted in every corner; winders or elliptical staircases should under no circumstances be allowed. Long flights without a landing are dangerous, and apt to lead to numerous accidents, while flights that are too short, say less than eight steps, offer a strong temptation to jump the whole distance; about ten steps to a flight will meet both these objections. In any school where the numbers reach 200, two staircases should be provided, placed, as far as possible, at either end of the building. Too great care cannot be exercised in the position and arrangement of the staircases. They should not finish close to the door of a class-room, for not only will the noise cause great inconvenience, but if the class in that room happens to be dismissed at the same moment that a number of pupils are coming down, there will be a likelihood of considerable disorder. A staircase discharging into the middle of a corridor at right angles will be apt to have the same effect, unless the corridor be of considerable width, or have an enlargement for the purpose.

The staircases leading to the cloak-rooms, especially in the case of schools with one large cloak-room, need considerable care in arrangement, since there are often very large numbers entering and leaving at the same time.

There is an excellent plan in the High School for Girls at Birmingham (Fig. 123), where there is one staircase used only for descent, and

at the other end one for ascent only. This not only saves a great deal of confusion, but has the further advantage that, when entering the school, the girls coming down by the one staircase leave their outdoor boots in the cloak-room, and entering the school by the other staircase in their house shoes, bring no outside dirt or dust into the building.

The landings on stairs should be square and of as large a size as may be possible, so that in case of two streams meeting there may be a backwater in which one lot may wait.

The stairs are sometimes doubled as far as the first floor (see Figs. 70 and 71). At the Bedford Grammar School the staircases discharge opposite a large bay window which allows considerable extra space.

The test of a well-planned staircase is the absence of any staircase rules in the school regulations.

The staircases should not be in the middle of the building, as the danger in case of fire is much increased, and should always be continued right up the building, *i.e.*, it is a dangerous plan to have two staircases up to say the first floor and one only to the second or third. In the case of panic, disaster would be inevitable. In America it is not uncommon to provide a special staircase outside the building to be used only in case of emergency (see Fig. 321).

There is considerable difference of opinion as to the relative advantages of box staircases, *i.e.*, those with walls carried up each side, or open stairs with balustrade. In "Modern American Schools," Mr W. Briggs speaks very strongly against open stairs, on the grounds of the great danger in case of the sudden pressure, if in case of fire or panic one child should fall, that would be suddenly brought to bear on the banisters and rail, giving a terrible story of an accident of this nature that happened some years ago in New York. But it should surely be possible to make the banisters and rail of sufficient strength. Strong objections are very often made to the box stairs in Secondary Schools, partly on the ground of their rather unsightly appearance, and also on the ground of the impossibility of effectual supervision. It is a considerable advantage to be able to see right up the stairs from the bottom.

Width.—The width of stairs may be considered from two points of view—first, that of the safety of the children while going up and down; and secondly, their power of quickly emptying the rooms above. For the first reason, it used to be recommended, in order that every child should have one wall and a handrail to prevent it from falling, that whatever the number of children in the school

the width of the stairs should not exceed 4 ft. "When the width is enough to allow of several children to go abreast, there is risk of those in the middle being pushed downstairs, and hence it would appear that 3 ft. 6 in. to 4 ft. as a maximum may be regarded as an extreme width sufficient for the largest schools." * This was for a long time the size adopted by the London School Board, but of recent years the tendency has been to make them wider, Mr Bailey,† architect to the London School Board, recommending from 3 ft. 9 in. to 5 ft. Provided that the steps are not of too steep a pitch, and the flights short with large landings, it would seem there is little danger in having them of considerable width. It is particularly important in Secondary Schools when classes often have to change their class-rooms, and so constantly going up and down, that two double rows should be able to pass one another. For this purpose 4 ft. should be regarded as a minimum.

In the German Schools the stairs are generally formed of considerable width. In Prussia the minimum width of stairs is fixed at 4 ft. 3 in. By the regulation issued in 1892 they are required to give :—

1. 2 ft. 3 in. for every 100 persons up to 500.
2. A further 1 ft. 7 in. for every 100 more up to 1,000.
3. A further 12 in. for every 100 persons above 1,000.

This would in the case of a school of 1,000 scholars mean a staircase breadth of nearly 20 ft. In this case, of course, the requisite breadth would be provided by having two or three staircases. The different States have different amounts laid down for the minimum breadth, but the average width of the stairs as built is just under 5 ft., and for large schools about 6 ft. 6 in.

Height of Risers.—The height of the risers is fixed by the Board of Education as not more than $5\frac{1}{2}$ to 6 in., with a tread of 13 in. This is, of course, for Elementary Schools. They can for Secondary Schools be fully an inch higher, say $6\frac{1}{2}$ in. risers with a tread of 12 in., or if there is room, 6 in. and 12 in. will be found a comfortable proportion. Care should be taken to see that the nosings do not project far over the treads, or there is a tendency to trip and fall going upstairs.

Much the same dimensions are found in German Schools. Werth recommends that the risers should be 16 cm. (about $6\frac{1}{4}$ in.), and

* School Architecture, Robson.

† The Planning of Board Schools. Paper read to the R.I.B.A., 1899.

gives the formula that twice the height in centimetres plus the tread should come to 63. In Prussia the height of risers is limited to $6\frac{3}{4}$ in. While differing slightly in different States, the average all over Germany comes to about 16 by 31 cm., that is to say, $6\frac{1}{4}$ in. risers and 12 in. treads.*

In America † the proportion again is the same, the width of tread being usually 12 in., while $6\frac{1}{2}$ in. is considered as a maximum height in High Schools, but which may be reduced to 6 in. for Primary Schools.

Material for Stairs.—While stone staircases are doubtless best for the Public Elementary Schools, they are not as a rule liked in Secondary Schools, and are strongly objected to in the case of Girls' Schools. Whatever material is adopted the construction must be thoroughly fireproof. Stone has the disadvantage of wearing slippery, nor is it to be depended on in case of fire, the steps being apt to crack off when subjected to heat. As a matter of fact, a solid staircase of some hard wood is the safest of all in case of fire. In the Boarding House ‡ for St Paul's Preparatory School, West Kensington, the staircases were all constructed of oak, after consultation with the Fire Brigade Authorities, as being the best fire-resisting material. The expense of this is of course considerable. A staircase formed of concrete with thick teak or oak treads will obviate most of the unpleasantness of an all-stone stair, with the additional advantage of making replacement of the treads easy when they become sufficiently worn to be dangerous. Iron staircases with treads of slate or steel and lead are often found in American Schools, and are there recommended.

But whatever material is finally determined upon, care should be taken to see that it is one that does not become slippery by use.

Handrails.—Handrails must of course be provided. In cases where there is very considerable variation of size in the children using the staircase, two handrails are sometimes provided. The custom of placing the small children on the ground floor in this country usually makes this unnecessary. The rails themselves should be about $2\frac{1}{2}$ in. diameter and of wood. Iron piping is sometimes used, but though serviceable, is disliked owing to its coldness.

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* Schulhygiene, A. Baginsky, and Handbuch der Architektur, vol. iv.

† School Hygiene, Shaw; School Architecture, Wheelwright.

‡ See Fig. 218.

CORRIDORS.

Corridors in schools which are not planned on the system in which the class-rooms open directly out of the hall become an important feature in the building. As great a width as can be managed should be allowed, the appearance and importance of the building being thereby increased. But in no case should a minimum width of less than 7 ft. be allowed, 9 or 10 ft. being better. It is a matter of great importance that the corridor should be thoroughly lighted in every part, as it serves for a number of purposes besides merely that of affording access to the class-rooms. In many schools it is customary to place the boys' lockers in the corridor, the advantage being that as they are spread over a large area, it is easy for a number of boys to get at their lockers at once. It also ensures their being in easily accessible positions, as for example in the Mercers' Company School in Holborn, recently erected (Fig. 117), as also in St Paul's School, West Kensington (see Fig. 112).

The material used for the floor of the corridor is of considerable importance. Not only must it be something that will not become slippery, but it must further be something that will not throw up dust. Concrete is particularly bad in this respect. Asphalte, which is sometimes found, is not satisfactory, being unsightly, dusty, and apt to wear into holes. Stone has the disadvantage of being excessively noisy in addition to most of the above drawbacks. On the whole, perhaps well-laid wood blocks will be found as satisfactory as anything, more especially if wax polished. In the basement corridors leading to cloak-rooms, lavatories, &c., red paving tiles can be used with advantage.

In the buildings where the corridors are of a fair size, say not less than 10 ft. wide, well lit and warmed, there is a great opportunity of adding to the attractive appearance of the school. It can be used as a sort of picture gallery for any prints, engravings, or pictures that the school may possess. Notice boards with school notices are frequently found there. In schools where special attention is paid to drawing and painting it is very common to find a selection of the best work done during the week pinned upon large boards hung in the corridors, providing not only an incentive to work, but a pleasant change of decoration. There are a great number of purposes to which a wide and spacious corridor can be put. Small divisions, when the school is rather full, can sometimes find here a quiet resting-place.

ENTRANCES.

The entrances to the school building for the pupils should of course be quite distinct from the main entrance to the building. They should be so arranged as to lead directly to the cloak-room, so that wet and muddy boots and clothes should not be taken farther into the building than is necessary. The entrance should be, as mentioned above, arranged with a special view to the cold and prevailing winds. This of course may be impossible in a town. There should be a large porch or covered entrance, as it often happens that pupils, for various reasons, arrive at the school some time before the building is opened, and unless there is some place in which to wait, they will have on rainy mornings to stand about in the wet till the school is open. If an inner entrance hall can be provided it makes a great difference to the comfort of the building in cold and windy weather. It also offers an excellent place to arrange umbrella racks where umbrellas can be left to drain, and not be brought farther into the building. The pupils' entrances should be so arranged that they can be clearly seen from some point inside the building. It often happens that it can most conveniently be overlooked by the Head Master's or Mistress's room, since the commonest place for that room is close to the main entrance, and the entrances are likely to be on the same side of the building. In larger schools, and generally in Boys' Schools, this business would naturally fall to the lot of the porter.

The tradesmen's entrance should of course be kept as distinct from the school part of the building as the site will allow.

Chapter VII.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

THE CLASS-ROOM.

Importance of proper Lighting—**Size of Classes** to be provided for—Average in English Schools—Ditto in Germany—The Factors which govern the Size and Shape of Class-rooms—Best Shape of Room—Methods of grouping Desks—Size and Shape of Desks—Great Variation in Size of Boys of same Age—Advantages and Disadvantages of Adjustable Desks—Position of Desks relative to Walls, Windows, and Doors—**Dimensions of Class-rooms** should suit type of Desk to be used—Class-rooms of English, German, and American Schools compared—Height of Class-rooms—Question of raising Back Rows—Position of the Fireplace—Ditto of Door—Teacher's Platform—Blackboard—Picture Rails, &c.—Sliding Partitions—Class-rooms in Elementary Schools—Maximum Number to be accommodated—Superficial Area to be allowed—Different Desks and their Dimensions—**Lighting**—**Day Light**—Difficulty of judging the Illumination Allowance to be made for Dark Days—Difference caused by Aspect, Surroundings, &c.—Height of opposite Houses—Use of Ribbed or Prismatic Glass—Proportion of Glass Surface to Floor Area—Position of Windows—Thickness of Piers, &c.—Top Lighting—Height of Window—Height of Window Sill—Model Class-room according to Erismann—Summary of Results—Form and Construction of Windows—Blinds—Colouring of Walls and its Effect on Light—Ceiling—**Artificial Lighting** — Requirements — Petroleum Lamps—Regenerative Petroleum Lamps—Gas—Gas Jets—Welsbach Incandescent Burner—Difficulty of—Siemens Regenerative Lamp—Suggested Position in Class-rooms—Acetylene Gas—Electric Light—Need of sufficient Lamps—The Number required—Their Position—Use of Holophane Globes—Lighting Rooms by reflecting Light from an Arc Lamp.

On the suitability and proper arrangements of the class-room in regard to light, ventilation, and warming, the comfort and health of a school depend to a very large extent. The class-rooms may be regarded as the units of which a school building is composed, to which the other rooms are subsidiary ; and since the teachers and scholars spend the greater part of their time while at school in these rooms, the importance

of having them properly lit and ventilated can scarcely be overrated. Medical opinion is practically unanimous on the point that short sight, now so prevalent, is caused, or at all events greatly aggravated, by working in badly-lit rooms during the period of growth; and since eyesight is so intimately connected with constitutional condition, bad air, caused by lack of ventilation, probably plays nearly as important a part as the want of proper light. As Dr Clement Dukes remarks in this connection—"It is a fact that boys working under unfavourable conditions, and with insufficient light during school life, are sustaining serious injury by the production of short sight." * Light, even if fairly strong, may, if admitted from the wrong direction, cause, besides injury to the eyes, many other long-lasting evils, such as curvature of the spine, crooked shoulders, &c., owing to the awkward positions adopted by the scholars to avoid sitting in their own light, or to get the best of what light there is.

A striking example of the effect of light upon sight was mentioned to the writer by Miss Creak, the Headmistress of the Birmingham High School for Girls. The school, when started some fourteen or fifteen years ago, was for the first seven years carried on in the old buildings of the Boys' Grammar School. The class-rooms, lit by windows with large mullions and heavily cusped, and the glass cut up into small diamond panes, were very dark. During these years the number of girls in the school who were obliged to wear glasses rose to 25 per cent. The school was then moved into a building which had been recently erected for the purpose of a club, and was well lit by large clear windows. During the five years the school was in this place the percentage of glass-wearing girls fell to 12. The school was a few years ago moved into a new school building erected for it.

It is, however, hardly necessary at this date to try and prove the necessity of care in the arrangement of class-rooms.

The Number of Pupils in a Class.—This varies not only with the school, but with different parts of the same school. In the middle and lower forms the classes are usually larger than those in the upper part of the school. The Prussian regulations require that in a Gymnasium the maximum number of a class shall not in the upper divisions exceed 30, in the middle 40, and in the lower 50. These are rather larger numbers than would be found in a First Grade Secondary School in this country, and as a matter of fact they by no means always reach

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* Health at School, p. 188.

these figures in Germany. The number of pupils in a class in Secondary Schools in this country is not as a rule above 30.

Taking a few schools at random from the Public Schools Year Book, we find the average size of classes to be as follows :—Bradfield College, 20 ; Ipswich School, 20 ; Merchant Taylors', 25 ; Repton, 25 ; Rugby, 25 ; St Paul's, 18-20 ; Westminster, 20. In some of the other old schools, however, the number is very often larger. Taking fifty of our leading schools, there is an average of rather under 16 boys to a master, exclusive of music-masters. This cannot, however, be taken as a fair index to the size of the classes, as all the masters would not be teaching at one time. It is generally agreed that one teacher cannot properly manage and regularly teach a larger number than 30, though there should be one or more rooms capable of accommodating 40 or more, and there may well be some of a smaller size ; but generally speaking, a class of from 25 to 30 may be considered about a standard size.

Having settled the number to be accommodated, the size and shape of the room depends—

1. On the floor space to be allowed per pupil.

2. On the size and form of desk employed, whether single or double desks.

3. On the method adopted in the arrangement of the desks, whether in single or double rows, size of gangways, &c.; the space taken up by the teacher's desk, blackboard, and cupboard, the fire or other heating apparatus, and the position of the door or doors.

4. On the distance of the desk farthest from the blackboard, *i.e.*, it must not be beyond the average sight distance.

5. On the necessity of so arranging the desks that all the pupils can see the master and blackboard easily, and also be seen themselves.

While there must be sufficient floor space allowed to make efficient ventilation easy—that is to say, it must not be necessary, in order to keep the room fresh, to change it at such a pace as to make perceptible draughts—at the same time it should not be larger than is absolutely necessary, in order to avoid a useless strain on the teacher's voice ; and as pointed out in the chapter on ventilation, it is not so much on the size of the room that good ventilation depends, as on the methods adopted for the supply of fresh air.

As regards the distance at which the average boy can see distinctly the ordinary writing, about 1 in., on the blackboard, the following figures show the result of some experiments made in Germany by

Zwez.* Of 81 children, 76 could read at a distance of 27 ft. 9 in., and 54 at 46 ft. 3 in.; finally he comes to the conclusion that anything under 35 ft. would be safe enough, and at this distance the teacher should be well able to see what all the class were doing.

The shape of a class-room that is found to be most satisfactory is that of an oblong with the main light on one, the long side, and that, of course, the left, other windows being subsidiary and more for ventilation; these should never bring in a light strong enough to overpower that coming from the windows on the left. German authorities lay down careful rules as to the proportion between length and breadth—Zwez, that the breadth should be not less than $\frac{2}{3}$ and not more than $\frac{3}{4}$ of the length; Lang, that the most suitable proportion is 3 to 4; Erismann again, from $\frac{2}{3}$–$\frac{3}{4}$ to 1.

The building construction regulations at Breslau lay down that the proportion of length to breadth must not be less than 5 to 3, and that the best form lies between this and the proportion of 4 to 3.

All authorities agree that the best form is an oblong with the lines of desks arranged at right angles to the long side. The exact shape and dimension of a class-room depend so much on the size and form of desks used, and their relative positions, that it seems hardly possible to lay down any hard-and-fast rule as to the proportion between length and breadth. On the whole, something near the proportion of 3 to 2 will give a satisfactory result.

A difficulty often arises in the arrangement of a class-room in small schools when the classes are too small to allow of a separate teacher to each. An oblong class-room to take 30 or 40 children may have been provided with the light on the left, but when the children are in two classes, the teacher naturally wishes to have his desk in the middle, where a command of both can be best obtained. In order to get this the desks are arranged the long way of the room, with the result that the pupils have their backs to the light while the teacher is directly facing it. In order to obviate this, it is well to ascertain beforehand how the classes will be arranged, and if two or more forms are to be placed in one room, to arrange that the lighting shall be, if possible, managed as in Fig. 11, with the main light from the end supplemented by a window at the back, but not placed opposite the teacher's desk.

School Desks.—In the Secondary Schools of this country and America, single desks are to be found as a general rule, arranged either in single rows, with space between every desk, or where it is necessary

* Schulhygiene, A. Baginsky, 1898, p. 217.

to gain space, in double rows, that is, two desks side by side, which, while allowing easy ingress and egress, and permitting the teacher to get easily to any pupil, economises a good deal of room by the omission of the extra gangways. This of course is much the same as using the double desk.

The difficulty of the question of desks lies in the very great variation in size among children during their time at school; not only the great differences natural to the considerable range of age, but the very great difference between children of the same age. Professor Bowditch of Harvard University, when making a careful investigation into the height and weight of nearly 25,000 school boys and girls of Boston, found the most surprising variations in the height of different pupils of the same age. These results are fully borne out by similar investigations in other parts of America and in Europe.* The results of his investigations showed a variation in children of the same age from 6 to 8 in.

This great variation in height at the same age makes the provision of desks varying in size obviously necessary, nor is it sufficient merely to have smaller desks in the lower form class-rooms, and so on, as it may easily happen that a big boy of eleven may be taller than a small boy of fifteen. It is commonly the plan to have two or three standard-sized desks to which, on the principle of the bed of Procrustes, the pupils have to accommodate themselves. The evils arising from continued use of badly designed desks, or of too great a disparity between the size of the desk and its occupant, are serious and long lasting. It should, however, be noted that the large differences are not as a rule common. Dr Kerr,† when measuring 1,600 children in five Elementary Schools in Bradford, found that 95 per cent. of the children came within 2½ in. of three selected heights.

The variations in height and differences in rate of growth can only be provided for fully by the use of some sort of adjustable desk, that can be easily altered to suit the needs of different pupils. This is done to a very large extent in America. But such a plan naturally means a considerable amount of trouble, and may, of course, in certain schools be impracticable. If, however, it can be managed that every pupil in the school has a properly adjusted desk for ordinary use, or in a Boarding School, in their preparation or work room, the gain to the pupil is so great that it should outweigh any slight consideration of

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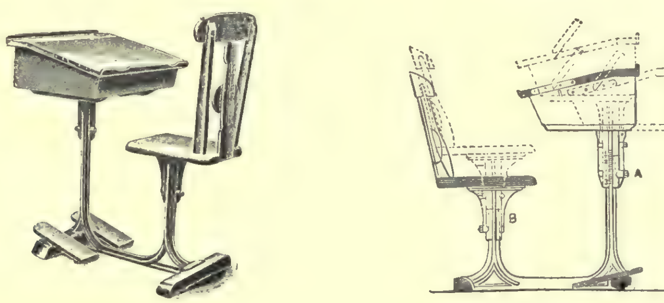
* Schulhygiene, Baginsky, p. 591, 1898.

† Journal of the Royal Statistical Society, Sept. 1897.

extra time or trouble. By having a simple contrivance for measurement, with a convenient and well-made type of desk, the trouble can be reduced to a minimum, especially if it be done systematically at the beginning of each term. It should, however, be added, that although adjustable desks are in many ways admirable, and, as a rule, very strongly advocated by medical writers on school hygiene, they are by no means always looked upon with favour by Head Masters and Mistresses of schools, owing to the great number of practical difficulties that stand in the way. In many schools it is not possible to arrange that the same boy or girl shall always occupy the same seat; classes are continually changing rooms, sometimes two or three times in a morning. Then again a constant and watchful eye must be kept upon such desks, or they may easily be more productive of harm than the ordinary form. Either the desk or the seat may slip down, a not un-



1. The Glendenning Adjustable Desk.

likely contingency under the manipulation of the ordinary school boy or girl, and may be unnoticed for a time.

An excellent form of adjustable desk is that invented by Dr M. Roth, and exhibited, I believe, first at the Health Exhibition. The desk shown in Fig. 1, made by the North of England School Furnishing Company, embodies the principles advocated by Dr Roth, and shows the method of working. The slope of the desk for writing is fifteen degrees, and for reading forty degrees.

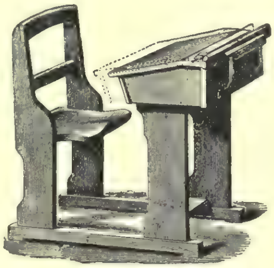
By means of a key and nuts on the columns supporting both seat and desk, either can be altered to any desired height, the desk itself being adjustable for horizontal distance. There are provided foot-rests, one on each side. It is probably better to adjust the height for the floor and omit these rests, since no child is the least likely to keep his or her feet upon them for more than a short time.

The most important factor in determining the comfort and suit-

ability of the desk, after the question of height has been disposed of, is the distance in a horizontal direction between the edge of the seat and the inner edge of the desk (see Fig. 2).

If the end of the desk projects over the edge of the seat, the overlapping part is known as "plus," and where there is a space between the two as "minus" distance. If a perpendicular line dropped from the edge of the desk just touches the edge of the seat, it is said to be "zero." This last, or a plus position, is usually considered the best, a minus position in any degree being bad (see Fig. 2). In order to keep this distance, and yet not make it too difficult for the pupil to get in and out, desks are made with a sliding top, the pupil, after being seated, pulling the desk in towards himself (see Fig. 3). This desk is often adopted in girls' schools with satisfactory results. It is hardly worth while laying stress on the fact of the necessity for great strength and simplicity, in the case of mechanism in school furniture, to withstand

2. Diagram to Illustrate Measurements of Desks.



3. The "Louise" Desk with Sliding Top (Hammer & Co.).

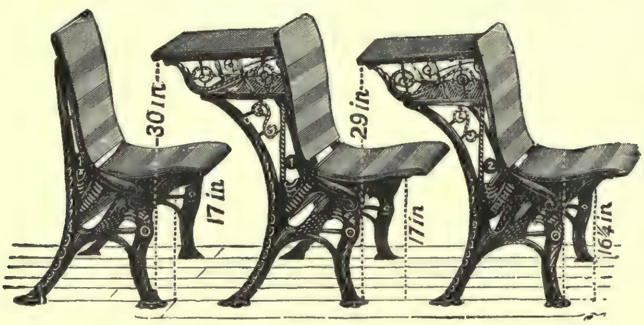
the wear and tear of school life and the persevering ingenuity of the schoolboy. Many forms of desks which work admirably in the shop soon succumb under this test. Desks known as "convertible," of which the top turns over to form a back or table, are as a rule to be carefully avoided. The different forms and patterns of desks are endless, and whether box desks or open desks are to be preferred depends of course on the school.

For the purpose of settling the dimensions of a class-room, the outside measurements of the desk and seat together are all that are necessary; in the case of desks with movable tops the measurement must of course be taken when open; 1 or 2 in. must be allowed between desks placed one behind the other to prevent shaking. The measurements of the different parts of school desks have been worked out with extraordinary care in Germany, and various writers lay down the dimensions necessary for pupils of different ages and heights worked

out to small fractions of a centimetre. The differences between the different writers are not great. According to Spiers, every school should be provided with standard desks of nine different sizes, of which every class-room should have three, these standard sizes to range from 1 ft. $7\frac{3}{4}$ in. to 1 ft. $11\frac{1}{2}$ in.* in breadth, the depth reckoning seat and desk together from 2 ft. $2\frac{1}{2}$ in. to 3 ft. $0\frac{1}{2}$ in.

Dr Baginsky, in his book upon School Hygiene, gives a large number of tables collected from all the German authorities, at the end of which he comes to much the same conclusions in regard to breadth, but slightly less in depth.

Dr Clement Dukes demands 2 ft. in breadth for the desk, which should be from 15 in. to 2 ft. in depth, with a seat of 12 in.



4. THE CANADIAN DESK.

The following table gives an approximate idea of the different sizes of desks and seats for different ages.† These dimensions apply to desks of the pattern in Fig. 4.

Size.	Height of Seat.	Height of Top.	Width of Top	Length.	Floor Space.	Age Accommodated.
1	17 in.	30 in.	16 in.	24 in.	28 in.	ADULTS.
2	$16\frac{1}{4}$ in.	29 in.	16 in.	24 in.	27 in.	16 to 21
3	$15\frac{1}{4}$ in.	$27\frac{1}{4}$ in.	14 in.	22 in.	26 in.	12 to 18
4	$14\frac{1}{4}$ in.	$25\frac{1}{4}$ in.	14 in.	22 in.	24 in.	10 to 15
5	$13\frac{1}{4}$ in.	23 in.	12 in.	20 in.	22 in.	8 to 12
6	12 in.	21 in.	12 in.	20 in.	21 in.	5 to 8

Taking into account the different shapes and sizes of desks, and the different measurements demanded by different authorities, it will be

* These dimensions are approximate, being turned from metres and centimetres to feet and inches to facilitate comparison.

† Taken from the Catalogue of the North of England School Furnishing Company.

found that for a full-sized desk in a Secondary School—that is to say, one capable of accommodating pupils up to the age of seventeen or eighteen—measurements of 2 ft. in breadth by 3 ft. in depth will be a sufficient allowance, while for the younger pupils about 1 ft. 7 in. by 2 ft. 3 in. This is the size usually allowed in the Elementary Schools when the double desks are 3 ft. 4 in. wide, 2 ft. 3 in. deep.*

Arrangement of Desks.—In arranging the desks in a class-room they should not be put close to the windows. It is a common thing to see the line of desks next the outer wall put right up against the windows, a bad plan for two reasons: firstly, the light will be caught by the window-sills unless bevelled off, and the desk will not be properly lit; and secondly, there is always a cold draught of air from the surface of the glass which would descend directly on the heads of those sitting too near the window. There should be a space of at least 18 in. The gangways where the desks are arranged singly need not be more than 18 to 20 in. wide. If double desks are used, or single desks in pairs, not less than 2 ft. should be allowed. In case the door into the room cannot be arranged to open into the free space in front of the desks, it will be necessary to have a gangway of at least 3 ft. wide down the side leading to the door. It must not be forgotten that a door so placed takes away from the seating accommodation of the room; otherwise this need not be more than 18 in., and 12 in. should be allowed behind the last row of seats at least.

In looking at the plans of a German School it will be sometimes noticed that the gangway next the inner wall is of a considerable width. This is owing to the custom of using that wall for hanging coats and hats upon. In the newer schools, however, cloak-rooms are supplied. In Germany, desks are not usually in the back row put nearer than 2 ft. 6 in. to the wall, and great care is always taken that no desks should be put right against any wall. The form of desk usually employed is some form of double desk.

Dimensions of Class-rooms and Floor Area Required.—Before considering in detail the measurements of class-rooms in this country, it has been thought worth while to give the dimensions and method of arrangement of desks usually adopted in Germany, showing two sizes. The smaller would correspond nearly to the Elementary Schools in England, the larger to the Secondary.

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* See Appendix A, Day School Code.

The following figures are taken from Dr Baginsky's work on School Hygiene, to which frequent reference has been made. The calculations are intended for a class-room to hold 48 scholars, and the dimensions are turned from metres into feet and inches.

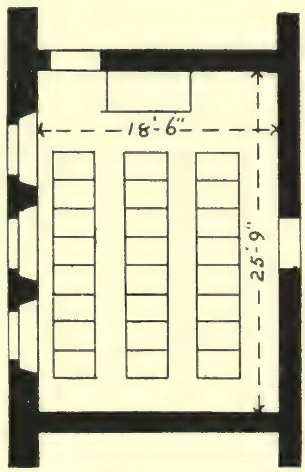
MEASUREMENTS OF A GERMAN CLASS-ROOM.

LENGTH.	For Younger Children. Ft.	For Younger Children. In.	For Older Children. Ft.	For Older Children. In.
Depth of desk	1	1¾	1	5¾
Depth of seat, including back	0	11¾	1	3¾
Making depth of whole desk	2	1½	2	9½
Eight rows, one behind the other	17	0	22	4
For teacher's desk and blackboard, &c.	6	6½	6	6½
Distance of back row from wall	2	5½	2	5½
Making length of room	26	0	31	4
BREADTH.				
Breadth of one place	1	7¾	1	11½
Three lots of double desks	9	10	11	9½
Space next window	1	1¾	1	1¾
Two middle gangways of 2 ft. 3½ in.	4	7	4	7
Gangway next wall	2	11½	2	11½
Making breadth	18	6¼	20	5¾

The room would be arranged as in Fig. 5, making the floor space in the case of the room for the younger children amount to almost exactly 10 sq. ft. per head—that is to say, the same amount that is required by the regulations of the Board of Education for Elementary Schools in this country. In the case of the room fitted with the full-sized desks, arranged in the same way, there would be an allowance of rather over 13 ft. superficial area per head. This would hardly be considered sufficient here, and is, as a matter of fact, usually exceeded in the newer German Schools. If, however, the desks are arranged in single rows, the additional space will bring up the floor area per head to what may be considered a sufficient allowance—that is to say, in the case of the room with full-sized desks, to about 15 sq. ft. per head. This will make the room come to just about the standard generally adopted in this country, viz., that not less than 15 sq. ft. of floor space should

be allowed per head. The same conclusion has been come to in America.

Mr Shaw* says, speaking of class-rooms: "Certain conclusions with reference to their size have at last been reached, and these conclusions have been so thoroughly tested and sanctioned by the most careful schoolmen, as to warrant their being regarded as standards. These standards are the results of investigations and repeated experiments, in which lighting, heating, ventilating, the needs of the child as to eye and ear, and other physical requirements, have been considered. They are the outcome of the special knowledge and recommendations of physicians, architects, and engineers, and of the practical judgment of schoolmen, after repeated test and modification. These standards demand in the first place 15 sq. ft. of floor space and 200 cub. ft. of air space for each pupil as the least amount of floor space and air space permissible for a schoolroom when all the needs of health are fairly considered."



5. German Class-room.

So that whether the question be approached by the arrangement of space necessary for the pupils' desks, teachers' apparatus, &c., or from the point of view of ventilation and cubic air space required for each pupil, the results are nearly the same.

The amount of floor space provided in some typical schools in Germany, England, and America is shown in the table given below. The measurements of those of the German schools have been turned from metres into feet and inches for the sake of comparison.

	No. in Class.	Length. Ft.	Length. In.	Breadth. Ft.	Breadth. In.	Sq. ft. per Head.
Höhere Bürgerschule - -	36	24	1¼	18	4¼	15
XII. Realschule, Berlin -	40	29	6¼	19	8¼	15
New Building, Lessing's Gymnasium, Berlin (Lower Forms)	48	29	6¼	21	4	13
New Building, Lessing's Gymnasium, Berlin (Upper Forms)	42	29	6¼	21	4	15
Realschule, Karlsruhe - -	36	31	3¾	19	8¼	17
Sekundarschulhaus, Zürich -	42	36	0	22	11½	20
Töchterschule, Basle - -	36	27	10¾	21	4	16
Mädchenschulhaus, Zürich -	48	37	0	22	11½	17

* School Hygiene, New York, 1901.

	No. in Class.	Length. Ft.	Length. In.	Breadth. Ft.	Breadth. In.	Sq. ft. per Head.
Boston High School - -	42	32	0	28	0	21
Do. do. - -	81	40	0	38	0	18¾
Professional High School, Pantuchet (Working Room) -	49	32	0	32	0	21
Professional High School, Pantuchet (Recitation Room) -	32	22	6	21	0	15
Schools of the Girls' Public Day School Company - -	30	21	0	19	6	13½
School for Boys, Barnard's Inn	30	24	3	23	0	18½
Judd Commercial School -	24	20	0	20	0	16½
St Paul's, West Kensington -	40	29	0	24	0	17½
City of London Schools -	40	24	0	22	0	13½

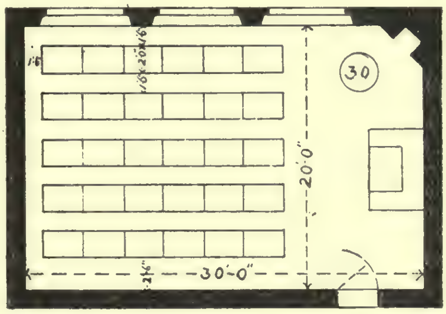
Dr Clement Dukes maintains that a class-room to hold 30 boys should be at least 40 ft. long, 25 ft. wide, and 16 ft. high. This would give over 33 ft. of floor space for each boy, a surely unnecessarily large allowance, if any means of ventilation are provided at all. The cost of building, were such space to be provided, would become almost prohibitive. Such a room would be certified by a Government School Inspector as capable of accommodating under the regulations 100 children in a Board School, and for a class of 30 would throw a great strain on the teacher. Though, of course, it would be pleasant to work in, the height of 16 ft. seems most unnecessary. Any air space above 12 ft. is of no use as regards ventilation, as it remains unaffected by movements of the lower air in the room, nor is it required for light. A room 25 ft. wide, where the desks are not actually against the inner wall, can be perfectly lit with a height of 13 ft.

But these dimensions are far surpassed by another writer on School Hygiene. Dr C. E. Shelley, Medical Officer at Haileybury College, in an article on the subject, gives the following recommendation: "The size of the room (class-room) can be calculated by allowing at least 800 cub. ft. for each inmate, reckoning not more than 12 ft. of wall height in doing so, and thus allowing 70 sq. ft. of floor space to each pupil." * While allowing that this may seem an extravagant allowance, Dr Shelley advances a number of arguments in its favour. But although interesting as showing to what lengths medical writers will go in the demand for cubic air space, it is difficult to regard it as a practical recommendation. On this scale a class-room for 30 pupils would measure 60 ft. by 35 ft. Such a room would be

* Articles on School Hygiene, *The School World*, August 1899.

impossible to light, as the height was limited to 12 ft.,* unless windows were placed on three sides at least, and only a few of the pupils, unless gifted with abnormally long sight, could read anything on the blackboard; the master could not make himself heard without a serious strain on his voice. The health of the master seems often overlooked in the anxiety for a very large allowance of space for the pupils. The additional cost of heating rooms of so great a size, and the additional expense, not only in the building, but the maintenance of such a school, would hardly be compensated for by the rather doubtful advantages of a building designed on this scale.

If not less than 15 sq. ft. be allowed for the maximum number for which the class-room is designed, the room may be considered to fairly fulfil the conditions demanded by sanitary science. If more can be provided, the results are no doubt better, but probably 20 sq. ft. should be regarded as a limit (see Fig. 6). Above that amount the extra heating required, and the additional strain on the teacher's voice, make the increase of room a doubtful advantage.



6. CLASS-ROOM GIVING 20 SQ. FT. PER HEAD.

In settling the sizes of the classes and the dimensions of the class-rooms in a building, there are several points to consider in order to avoid waste of space, which become of considerable importance in the case of a building where it is necessary on financial grounds to take full advantage of every square foot of space. The total area of class-room is usually governed by the amount of superficial floor area to be allowed per pupil. Unless this amount is so large as to make the arrangement of desks immaterial, the exact dimensions of the length in proportion to the breadth should depend upon the form of desks that are to be used. For example, if 15 sq. ft. be determined upon as the floor space to be allowed, a class-room for 48 pupils will require 720 sq. ft. This will be provided by a room measuring 32 ft. by 22 ft. 6 in. Now if single desks are used, it will be found that according to the measurements given below, there is exactly room for 6 rows of desks 8 deep, allowing for gangways, master's desk, &c.

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* It is suggested that the lowness of the rooms will enable a considerable saving in the cost of building, additional height being of no use for ventilation.

If, on the other hand, the room had been made say 29 by 25 ft., the necessary area or rather more is still provided; but when the desks come to be put in, it will be found that there is not quite enough space to allow of an extra row of desks in the width of the room, thus necessitating another line in depth, so that while there is a waste of space down the side of the room, there is not sufficient room for the master and his desk. On the other hand, by keeping these dimensions, and substituting double desks, there will be just room for 4 double desks in the width, and as this gives 8 places in the width, there will only be 6 rows in depth, so that plenty of room will be left for the master. A room measuring say 30 by 24 ft. will suit neither single nor double desks without putting them too close together, or not leaving room for the master's platform. This will be made clear by looking at Figs. 7 and 8. Of course, if widths for the gangways, &c., different to those given above are determined upon, the same questions arise, but naturally with different figures. In any case, a more satisfactory plan can be produced if the type of desk be settled beforehand. A somewhat similar question arises in determining the different sizes of the classes that are to serve as the units for the class-rooms. These numbers should be arranged to suit the type of desk that is to be used. For example, if single desks are used, a class of 20 conveniently splits up into 4 rows of desks 5 deep. On the other hand, with double desks it would be necessary to make the number 18 or 24 in order to get a complete number of rows—that is, 3 double desks in a row 3 deep or 4 deep. If single desks are used, it will be found economical to make the units for the class-rooms 15, 20, 25, 30, 35, 40, 48; while double desks can be more conveniently arranged with classes of 18, 24, 30, 36, 42, 48.

Again, since the plan of a school generally involves a long row of class-rooms of the same width but of different lengths to suit the varying numbers of the different classes, the question as to the most convenient dimension for their width becomes of some importance. To give instructions to the architect to provide so many class-rooms of such and such sizes without reference to anything but floor space will not improbably result in forcing him to waste a certain amount of space, whereas, if, as mentioned above, the form of desk be first settled, and then the width that will take a convenient number of the desks, all the class-rooms can be settled to take a multiple of that number. For example, if single desks are used, and a row of 5 desks be considered a convenient width, the classes would run in multiples of 5—15, 20, 25, 30, &c., making 3, 4, 5, and 6 rows in depth; if double

desks are used, 3 pairs of desks make a convenient width, until it is necessary to provide for larger numbers, so that in this case the class-rooms should be built for multiples of 6. The fact that classes are seldom found of the exact number which the room is intended to take does not affect the question, as it is the initial waste of space involved in providing for inconvenient numbers that is to be avoided.

All this may seem very obvious, and the differences insignificant, but in the first place, it is so common to see in the instructions for a new building merely the numbers that the different class-rooms are to hold given with no reference to anything but floor space, that it has been considered worth while to draw attention to these points. In the second, while it is true that in buildings put up without much regard to expense, with large class-rooms giving a generous allowance of floor space, and leaving the matter of desks to chance, on the ground that there is plenty of room, such details are naturally of small consequence; but in a school building when every foot of space and every penny in the cost has to be carefully considered, such a question should assume great importance, since a waste of only 18 in. down the length of the class-rooms of a school having say 20 class-rooms of an average length of 20 ft. would mean an area of 600 sq. ft.—that is to say, a sufficient space to provide a class-room capable of containing about 40 pupils.

For the master's desk and platform at least 7 ft. must be provided. In the case of a wide class-room, more will be necessary. A class-room will then work out as follows:—

	Ft.	In.
Width of desk (full size) - - - -	2	0
„ of gangway for single desks - - -	1	6
„ of gangway for double desks - -	2	0
„ of gangways next wall - - -	1	6
If there is a door in the wall and passage room to be provided, the inner gangway next wall - - - - - -	3	0
Length over desk and seat together, allowing for space between - - - - -	3	0
Space behind back row - - - -	1	0
Space for master's platform at desk - -	7	0

If these measurements are taken, it will be found that for small numbers considerably more, and in large classes at least 15 sq. ft.

per head, will be provided. For example, a class of 48, arranged in 6 rows of 8 (see Fig. 7, c):—

WIDTH.

	Ft.	In.
6 rows, 2 ft. wide - - - - -	12	0
7 gangways, 1 ft. 6 in. - - - -	10	6
	22	6

LENGTH.

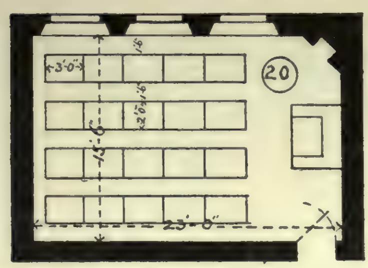
	Ft.	In.
Master's desk and open space - - -	7	0
8 rows, 3 ft. deep - - - - -	24	0
Space behind last row - - - -	1	0
	32	0

giving a room 22 ft. 6 in. by 32 ft., making 720 sq. ft. or 15 sq. ft. per head.

Taking these dimensions for gangways, desks, &c., the following three tables have been worked out:—(1.) Showing the arrangement of seats and dimensions for class-rooms to take different numbers with the seats arranged in single rows, but with no particular regard to floor space—that is to say, allowing plenty of room for moving about, &c., and leaving the actual floor space per pupil to work out as it happens to come. (2.) A table showing class-rooms so arranged as in every case to allow exactly the standard of 15 sq. ft. per pupil, but keeping the necessary width for gangways, &c. (3.) Class-rooms arranged with double desks keeping the necessary intervals between desks, &c., but allowing no superfluous room, in order to gain floor space, thus reducing it below the amount of 15 ft. The height of the rooms throughout is reckoned at the constant figure of 13 ft.

The sizes given for the windows are arranged to correspond with the figures given in the latter part of this chapter (see page 108), and give in each case a proportion of window opening of 1 to 4 with regard to the floor area. The positions of the windows, fireplace, and door are also based upon the conclusions come to in this chapter. These positions are, for all window openings, the left-hand side of the pupils as they sit, for fireplaces in the angle to the right of the teacher, and therefore on the window side of the room, and for doors, at the teacher's end of the room on his left.

It should be noted that these tables are not intended as a limit to the size of class-rooms.



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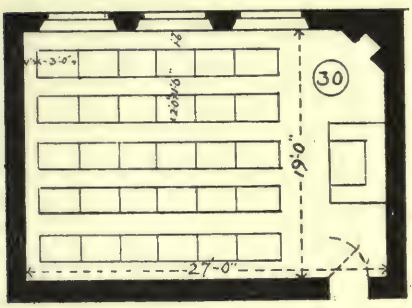

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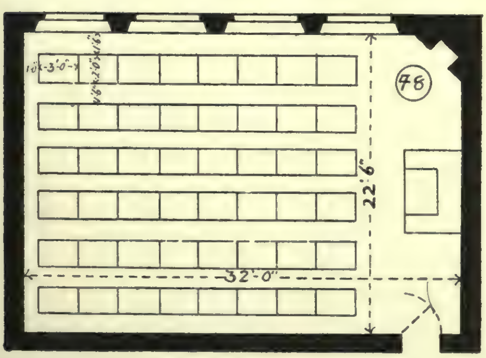

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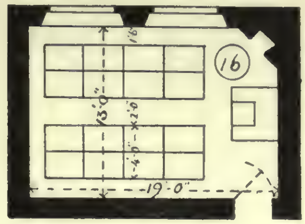
7. Single Desks.



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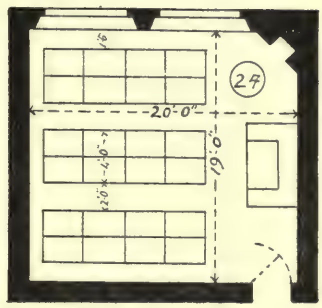

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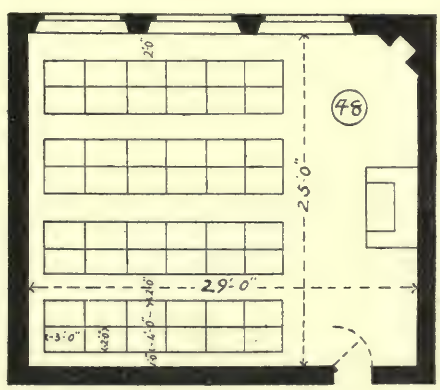


C

8. Double Desks.

To illustrate Tables on page 94.

DIMENSIONS OF CLASS-ROOMS.

I. Single Desks.

No. in Class.	Arrangement.	Length.	Breadth.	Height.	Area.	Approximate Floor Space per Head.	Windows. No.	Windows. Size.
	Wide. Deep.	Ft.	Ft.	Ft.	Sq. ft.	Sq. ft.		Ft. In. Ft. In.
*20	4 rows of 5	23	16	13	368	18$\frac{4}{5}$	3	3 9 × 8 6
25	5 „ 5	23	19	13	437	17	3	4 0 × 8 6
*30	5 „ 6	27	19	13	513	17	3	5 0 × 8 6
35	5 „ 7	30	19	13	570	16$\frac{1}{3}$	4	4 3 × 8 6
40	5 „ 8	33	19	13	637	15$\frac{1}{2}$	4	4 6 × 8 6
*48	6 „ 8	32	22$\frac{1}{2}$	13	720	15	4	5 0 × 8 6

II. Double Desks (to provide 15 sq. ft.).

No. in Class.	Arrangement.	Length.	Breadth.	Height.	Area.	Approximate Floor Space per Head.	Windows. No.	Windows. Size.
†16	2 rows of 4	19	13	13	247	15	3	3 3 × 8 6
†24	3 „ 4	20	19	13	380	15	3	3 9 × 8 6
30	3 „ 5	24	19	13	456	15	3	4 0 × 8 6
36	3 „ 6	28$\frac{1}{2}$	19	13	541$\frac{1}{2}$	15	4	4 0 × 8 6
42	3 „ 7	33	19	13	627	15	4	4 6 × 8 6
†48	4 „ 6	31$\frac{1}{2}$	23	13	724	15	4	5 0 × 8 6

III. Double Desks.

Minimum dimensions to allow of sufficient room for gangways, &c.

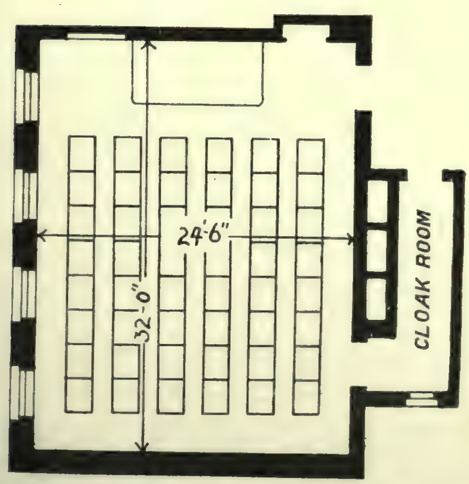
No. in Class.	Arrangement.	Length.	Breadth.	Height.	Area.	Approximate Floor Space per Head.	Windows. No.	Windows. Size.
16	2 rows of 4	19	13	13	247	15	3	3 3 × 8 6
24	3 „ 4	20	19	13	380	15	3	3 9 × 8 6
30	3 „ 5	23	19	13	437	14$\frac{1}{2}$	3	4 0 × 8 6
36	3 „ 6	26	19	13	494	13$\frac{2}{3}$	3	5 0 × 8 6
42	3 „ 7	29	19	13	551	13	4	4 3 × 8 6
48	4 „ 6	26	23	13	598	12$\frac{1}{2}$	4	4 6 × 8 6

Note.—For class-rooms in Elementary Schools see pages 101 *et seq.*

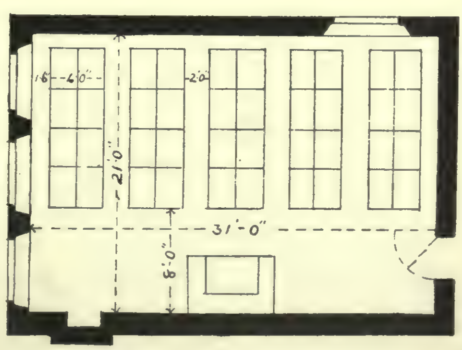
* See Fig. 7. † See Fig. 8.

It will be noticed, on looking at the above tables, that until the class reaches the number of 40, the single arrangement of desks, if the distances suggested above are adhered to, is not an economical arrangement as regards spaces in those cases where 15 sq. ft. is regarded as a sufficient allowance. As regards the third table, it will generally be found that when any satisfactory method of ventilation is provided and properly used, rooms supplying 13 sq. ft. or even less can, if the classes are not very large, be kept in quite a satisfactory condition as regards ventilation, especially when they are

9. Interior View of an American Class-room.



10. An American Class-room for Forty-eight Pupils.



11. Shallow Class-room for Forty.

not in continual use; and no doubt it would be possible, in all the class-rooms given above, to diminish the width for the gangways without interfering very much with the work of the form, but where possible it is inadvisable to narrow them, as it makes it difficult for the master or mistress to move easily about the room.

In Fig. 10 is shown the plan of an American class-room, but it is not easy to compare an American School class-room with either an English or a German room. In the newer High Schools in America it is customary to provide a very large amount of floor space per head—for example, in the Boston High School there is given over 21 sq. ft.; but it must be remembered that these rooms are used by the pupils for private work, the actual teaching being usually carried on in smaller rooms called recitation rooms, so that the objections to class-rooms of too large an area do not strictly apply to such rooms.

In the case of a shallow class-room it is necessary to supply additional light at the back. In this case the window should be placed at the end of the room as in Fig. 11, in order that it should not be opposite the teacher (see also Fig. 19).

It is sometimes an advantage in arranging the desks in a room intended for young children to provide for a semicircle of seats in front of the master's desk in addition to the regular desks for writing work. This enables the class to be called out for oral work, making a pleasant change of position, and enabling the master, if he wishes, to stimulate the work by place-taking, &c.

The arrangement of a class-room for "criticism" lessons, required for student teachers, is given when dealing with Training and Practising Schools.

Height of Class-rooms.—The height of the class-room depends (1) on the distance which it is necessary for the light from the side windows to go; (2) on the cubical space to be provided for each pupil. From the point of view of ventilation, 13 ft. may be considered ample. A common rule is that the breadth of the room should not exceed twice the clear height. In the regulations issued by the Board of Education, it is laid down that in a room 14 ft. high any space beyond 24 ft. from the window wall is insufficiently lighted. But it is usually held that a room 13 ft. high can safely be made 25 ft. wide, and if the seats are arranged with a gangway next the inner wall 2 ft. 6 in. or 3 ft. wide, a less height than 13 ft. will be sufficient for the purpose of effective lighting, since the farthest desk from the window will be under 23 ft. The height allowed in German Schools varies

from 13 ft. to 13 ft. 6 in.; as, for instance, in Berlin, the Falk Gymnasium, 13 ft. 6 in.; the Lessing Gymnasium, 13 ft.; the last-built Realschule and the Höhere Mädchenschule are both 13 ft. 1 in. Much the same measurements prevail in the more recent Elementary Schools. In some Elementary Schools, however, in Berlin, it is as low as 12 ft.

In this country there is a tendency to allow rather more height, but it may fairly be assumed that 13 ft. is sufficient, the height of a room being governed really by the question of light. Where the rooms are not more than 20 ft. wide, a rather less height may be allowed; over a width of 25 ft. the height must be increased above 13 ft. to effectually light the side opposite the window.

Doors.—The doors to a class-room should be wide enough to allow of the necessary furniture being taken in and out, say from 3 ft. to 3 ft. 3 in. Their number and position naturally depend on the rest of the plan of the school. The best, and, as far as space is concerned, most economical position, is close to the teacher's end of the room, so avoiding the necessity of a wide gangway. The upper panels of the class-room doors are often glazed with clear glass, to allow of the Principal inspecting the classes without disturbing the class. This is not always approved of, and it is as well that the question should be settled when building.

A fanlight or hopper ventilator should always be placed over the door for ventilation purposes, the full width of the door.

Raised Seats.—The plan of raising the three rows at the back of the room by means of steps, though apparently having advantages in enabling the pupils in the back rows to see better, and usually adopted in Elementary Schools where the numbers in the classes are of course very much larger, is not found to be satisfactory in Secondary Schools, for many reasons. The desks must be fixed to prevent their being pushed or slipping over the edge; this makes efficient cleaning impossible; the top of the desk and some 9 or 10 in. below are invisible to the teacher unless a person of unusual height, so that effectual supervision cannot be kept. The steps having to be of considerable length, 2 ft. 6 in. to 3 ft., make it difficult to move up and down, and as there is usually a hollow space underneath the raised part, the noise is very great. Finally, it is urged that there is so much taken away from the cubic capacity of the room, though this is probably not of great importance.*

* If the seats are much raised it becomes easy for the pupils to see and copy the work of those in front.

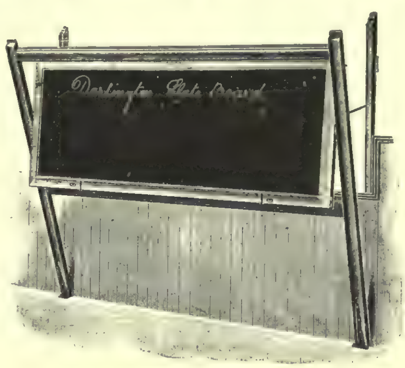
In lecture-rooms, where it is necessary for every one to see the top of the demonstration table during lessons, it is of course necessary to have raised seats. The better plan in ordinary class-rooms is to have the teacher's desk and seat on a platform raised a little above the floor, but not more than 6 or 8 in. The only rooms in which galleries are now used are as a rule those for very small children, and known usually as babies' rooms (see Fig. 277). An infant school has, as a rule, one room arranged with a semicircular raised gallery.

The Fireplace.—The position of the fireplace, where this form of heating is in use, is of considerable importance. The centre of the wall behind the teacher is a very inconvenient place for the fire, as it interferes both with the position of the teacher and of the blackboard. The position shown in the figures (Figs. 7 and 8), where the fireplace is on the right of the teacher and the door on the left near the end of the room, has many advantages. The fireplace is then well out of the way—it is on the cold, *i.e.*, the window side of the room, and so is in an advantageous position for warming; and should it be a ventilating grate, it can draw its necessary supply of fresh air with the smallest length of duct. It is objected against this position that it puts the teacher in an unpleasant draught, since he is then in a direct line between the door and fireplace, and if there is no provision for the entrance of air beyond the cracks under the door, &c., this is no doubt the case, but provided there is other provision for air, or if a ventilating grate be used, little objections will be found on this score, more especially if the corridors or hall from which the class-rooms open are kept up to a moderate temperature. This arrangement has been extensively adopted in the schools of the Girls' Public Day School Company, and has been found to work well. Probably the next best position, and one that is often preferred, is on the left of the teacher (see Fig. 30). If the entrance door is close to the fire, the danger of dresses catching fire, in the cases of Girls' Schools, should not be overlooked.

The Blackboard.—This very important piece of furniture should be fixed, and as large as possible. Movable blackboards are most inconvenient and troublesome things. In lecture-rooms it is convenient to have a large blackboard that will run up and down in grooves. A method of hanging a board that allows the best use to be made of the light is shown in Fig. 12; this can also be reversed. In this country it is usual to supply a blackboard for the teacher only, while in America work is done upon the blackboard, which is carried right round the room, by all the pupils; the usual height being 3 to 4 ft. according to grades.

This supply of almost unlimited blackboard is spoken of very highly from the educational advantages gained by being able to send children to work at it. Apart from this it is a great boon to the teacher, as it is then possible to leave up what has been written, not only for the lesson, but even for days if wished, while a small blackboard necessitates erasure of what has been written before anything new can be put on.

The best material for a blackboard is probably roughened glass coloured black or dark green at the back, though the objection to this is that it wears away the chalk so quickly that it is difficult to keep a point for writing. Next to this dark green or black slate. It should be of some material that can be easily washed. Where expense prohibits a sufficiently large provision, a fairly effective substitute can be made by the use of strong Manila paper blackened. Attempts are often made to treat the wall with various arrangements of cement blacked. The makers usually promise that this will keep its colour, but so far the results have not been successful. Of the many different kinds that I have come across, none—even some that had been recently done—had kept anything like a black surface. A grey surface is injurious to the eyes. Various makers of school apparatus have substitutes for the ordinary wooden blackboards, some of which are satisfactory. A material called the Darlington slateboard is one of the most successful, as it improves with use, and does not reflect the light unpleasantly. There should be under the board a chalk trough about $2\frac{1}{2}$ in. wide; it will save a good deal of dust if this is covered by an open woven wire cover, which can be taken off for cleaning. It will be found a great convenience, when there is not a blackboard running all round the room, to provide two flat wooden rails let into the walls, about 2 in. deep and about 2 ft. apart, the lower at the height of the dado. These may be carried round all the available wall space in the class-room to serve to pin up on all kinds of things, notices, good work done by some pupils, time-tables, &c.; if they are let in flush with the wall, black paper pinned upon them will serve for extra blackboard. There should also be a picture rail fixed round the walls. A rail fastened on the floor at a distance of 6 in. from the wall is a useful precaution. In the first place, it prevents the desks being put actually touching the walls—a common habit; and secondly, when the desks are moved about for



12. Movable Blackboard.

cleaning or rearrangement, it prevents holes being knocked in the wall. The plan of rounding the angles between the walls and floor and ceiling as in a hospital, to make effective cleaning easier, is sometimes found and recommended by medical authorities.

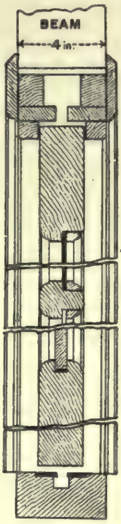
13. THE CLIMAX PARTITION (HALF OPEN).

A thermometer should be found in every class-room, and the temperature entered upon a chart at the opening and closing of school. This will be found of great assistance in case of complaints as to cold and heat, &c. It should not be placed on a wall, as that is usually colder than the air in the room, especially if the room is heated by hot air. A common plan is to hang it to the gas pendants. In the newer Berlin schools it is so arranged with a glass panel in the wall that the school keeper or porter can see how the temperature in the class-rooms stands without disturbing the class.

Sliding Partitions.—Sliding partitions for the purpose of dividing the class-rooms so that they can be thrown together when desired, are made in many forms, almost every maker of school furniture having a pattern of their own. The two methods illustrated here have been extensively tried with success. The principle upon which they are both based enables them to be shut up flat against the wall, and so to occupy a very small space when closed. In Figs. 13 and 14 is shown the form of partition made by the North of England School Furnishing Company. A noticeable feature of this partition lies in the arrangement

14. THE CLIMAX PARTITION (SHUT).

of the runners. The weight of the partition is carried by the floor (see Fig. 15) and moves upon ball bearings; the advantage claimed for this is freedom from any liability to sticking, such as might be caused by the sagging of a beam if used to support the partition—the sill in the floor only requires a depth of two inches.



15. THE CLIMAX PARTITION.

Another widely used partition is that made by Messrs Peace & Norquoy (see Fig. 16). The method of working this partition also enables it to be shut up against the wall. In either case it is possible to put in a door whenever it may be desirable. The method of separating class-rooms by sliding partitions is rather on the decrease now, as the custom of having a responsible teacher in charge of each form is becoming more common; but their use to cut the class-rooms off from a hall, so that the size can be easily enlarged by throwing the class-rooms into it, is perhaps on the increase. In some American Schools the rooms are so arranged that it is possible to clear a whole floor in this way. Where the organisation of the school does not require the daily use of a hall, this method is, no doubt, an advantage, as a large room can be made at any time for the purpose of any social function or assembly of the school, while avoiding the expense of building a large room for the purpose. It is, however, unlikely that such a plan would be regarded with favour in this country.

16. SLIDING PARTITION—MESSRS PEACE & NORQUOY.

ELEMENTARY SCHOOL CLASS-ROOMS.

It has been considered best to consider the class-rooms for Elementary Schools in this place, although this part of the book is

devoted to Secondary Schools, since so many of the questions, such as lighting, &c., requiring to be dealt with are the same for both kinds of schools, whilst the dimensions of desks and other measurements given for class-rooms in Secondary Schools are equally adapted for Higher Grade Schools, in which the Government regulations now require a floor space of 15 sq. ft. per pupil, and where the pupils stay until the age of sixteen or older. The chief difference between an Elementary School class-room and that of the Secondary lies in the relatively larger classes in the former, and the smaller amount of floor space that is generally provided. The size of desks provided is also of course smaller, as the children leave at the age of fourteen; though, as there are Evening Continuation Schools carried on at most of the Board Schools, there is a good deal of discomfort caused by the smallness of the desks to the older scholars attending these classes.

Size of Classes.—This is to some extent dependent on the arrangement of teachers, *i.e.*, how far pupil teachers are made use of, &c. The tendency is now strongly in the direction of a properly certified teacher to every class, with a separate class-room.

In order to provide against the great loss of space necessarily caused by having all the class-rooms of one size, the London Board in 1900 adopted a definite grading of the accommodation of class-rooms, as far as new schools were concerned, on the basis that class-rooms for Standard VI. and over shall not accommodate more than 40 children; Standards IV. and V. not more than 50; and for Standards I., II., III., not more than 60. This has followed naturally from the regulations previously laid down by the Board in regard to the number of teachers required for the efficient staffing of schools, it being obviously more economical to have the class-rooms to suit the size of the class.

The large Provincial School Boards usually take 60 as the standard size of a class, and this number may fairly be taken as a limit. It is unusual to find in our Elementary Schools much larger classes than this, though of course a class of 70 or even 80 may be occasionally necessary. In Germany there are somewhat similar-sized classes, though, as a rule, what difference there is, is in the direction of rather larger numbers. Dr Adolf Baginsky, after discussing the question at some length from the various points of view, the powers of supervision of the master, and the difficulties of ventilation, &c., in dealing with larger numbers, comes to the conclusion that the maximum number that should be allowed in one class is 60, also remarking that the maximum number allowed by the Government regulations in the different States is too high.

In the Frankfort regulations it is laid down that in a Public Elementary School one teacher can take 80 children. In Berlin the numbers are fixed at 69 for the lower classes, 60 for the middle, and 50 for the upper forms. In 1896 the average number in a class in the Public Elementary Schools in Berlin was 52.45. In Austria, by the Ministerial Decree of 1873, the maximum number is fixed at 80.

The amount of superficial area to be allowed per head is laid down by the regulations of the Board of Education as 10 ft. in the schools for older scholars and 9 ft. for infant schools. This amount of floor space is universally adopted as a minimum in this country, as no school can get any of the Government grant which fails to comply with this requirement.

In the Elementary Schools of Germany, as a rule, the amount of floor space per head is smaller than this. In four Elementary Schools of Berlin the amount allowed is between 8 and 9 ft.

The following table shows some amounts actually provided in Elementary Schools: *—

Prussia - - -	6.45 ft. (approximately).
Hesse - - -	8.60 „
Baden - - -	8.60 „
Wurtemberg - -	6.50 „
Saxony - - -	6.50 to 7.50 ft.

These figures are rather below that demanded by German writers and authorities. According to the *Aerztliches Gutachten, Elsass-Lothringen*, 1882, the amount allowed should be 1 sq. metre, about 10¾ sq. ft. Hinträger gives from that to 14 ft.

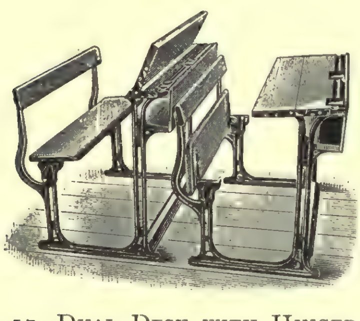
Mr Edward Shaw, in his book on School Hygiene, speaking of America, protests very strongly against the plan of allowing less space per head in Primary Schools than in the Higher Grade Schools, pointing out that the additional space gained by the smaller desks which are required is especially needed to allow of opportunity to carry on the different exercises and activities which are so essential a part in primary teaching. The additional floor space allows, he urges, provision for the extra motor activities of primary pupils, who should not spend more than one-third of their time at school actually in their seats. For this purpose he suggests keeping the size of the room which would be required for 48 older pupils, limiting the number to 40, and arranging the desks rather to one side of the room. This plan of allow-

* Schulhygiene, Baginsky, 1898.

ing, as it were, space for play or drill in each class-room makes a great demand on space. It would seem, that given a well-planned school, with the class-rooms arranged round a large school-room or hall, the advantages of movement and exercise could be gained without so great a sacrifice of space.

The arrangement of desks usually adopted in this country is that of the double desk. These are always found in the schools of the London School Board and most of the Provincial Boards. They are almost universal in Germany, and are no doubt the most satisfactory form of seat where sufficient space cannot be allowed for the single desk.

These desks are made in considerable variety, with various arrangements, more or less successful, for altering the slope of the desk, or raising a flap to act either as a reading-desk or to facilitate standing up (see Fig. 17).



17. Dual Desk with Hinged Top.

18. Long Desk with Separate Seats.

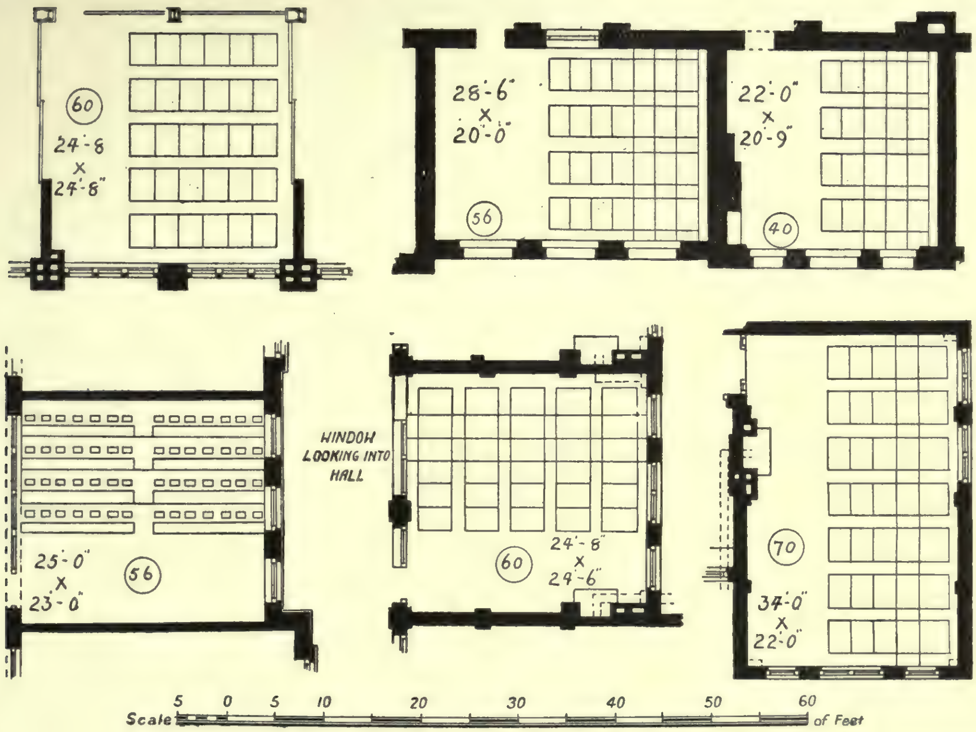
There is a form of desk which has some advantage in economising space, and that is a long desk to take nine or ten or more scholars, but with a separate seat to each scholar instead of a bench. This ensures that there should be no crowding, and that no more pupils than the room is designed for should be put in, while at the same time providing for the easy ingress and egress of any particular one, the teachers being able to walk along the back (see Fig. 18). For this purpose not less than 18 in. per pupil should be allowed in breadth.

The dimensions of the double desk for Elementary Schools above the Infant Department, according to the regulations of the Board of Education, should not be less than 3 ft. 4 in. to give sufficient room for writing. The depth will be from 2 ft. 3 in. to 2 ft. 6 in.

It is customary in Elementary Schools to raise the back rows slightly, the last three or four rows being placed on steps 4 or 5 in.

In Fig. 19 are given a number of class-rooms taken from recently erected Board Schools in London and the large provincial towns, which will show the various plans of arranging the seats for different numbers.

Desks are still used in a number of schools which are capable of taking four or five pupils. They are as a rule made with a flap to turn up for the purpose of allowing easy ingress and egress,



19. Six Class-rooms from Elementary Schools.

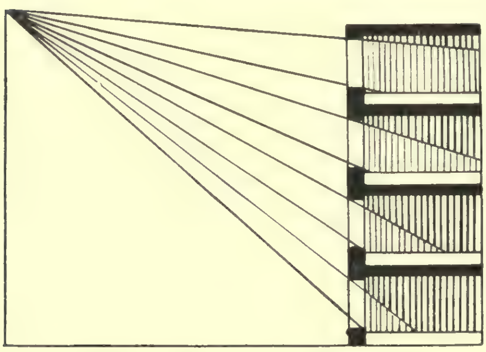
and also to make a reading desk. In a desk of this length, the flap being of considerable length, is very heavy, and it is as well for the teacher to be prepared to deal promptly with crushed fingers or bruises, since a boy at one end may turn down the desk unperceived by those at the other.

THE LIGHTING OF CLASS-ROOMS.

As mentioned above, too much care cannot be exercised in the proper size and position of windows. Provided that there is no actual glare in the eyes of the pupils or teacher, it is hardly possible that a room can be too well lit. The question as to whether a room is sufficiently lit or not is one very difficult to decide, for a class-room may on entering

appear bright and well lit, and as far as the general illumination is considered, may be so; but when a more careful examination is made in different parts of the room, it will often be found that the light on a certain number of the desks is below what should be considered the minimum allowance.

Another point which cannot be too strongly borne in mind is that the amount of glass space to be allowed should be calculated for the dark and overcast days. Many class-rooms admirably lit in fine bright weather do not provide nearly enough window space for the dull days of winter. As Javal* says, "The class-room should be flooded with light, so that on dark days the corner of the room farthest from the windows shall have sufficient light." There is little danger of having too much light; adjustable blinds will meet the rare occasions when the light is too strong and dazzling. From an experiment† made in America, it appears that the light in a room into which the sun is not shining directly will be three times as strong when the sun is out as when the sun is obscured by a passing cloud.



20. Showing Effect of opposite Houses on Light.

The question of the best aspect for class-rooms has been already discussed when dealing with the position of school buildings. As most of the work in a school is done in the morning, the conclusion come to was that the best light will be obtained from the south-east and south. Even on dull cloudy days the light from that direction is considerably stronger than that from the north. Wien found that on a dull cloudy day test type which could not be read at a distance of 4 or 5 ft. in a class-room facing north was clearly legible in one facing south, the windows in both cases being the same size, and the school building standing clear of houses and trees.

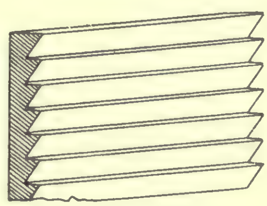
The most important factor in regard to lighting after that of aspect is that of the surroundings of the school building. This of course refers chiefly to schools built in towns, and at any place where there are houses sufficiently near to intercept some of the light on one or more sides. Where there are high buildings opposite the school, some portion of

* Hygiene des Auges, 1880.

† School Hygiene, Shaw, 1901.

the class-rooms, *i.e.*, the part farthest from the windows facing that way, will be insufficiently lit, this proportion of badly lit space decreasing of course in each story upwards (see Fig. 20). In the case of a street, it is sometimes reckoned that the minimum distance to be allowed is, that the breadth of the street, *i.e.*, the clear space between the two opposite houses, should at least be equal to the height of the houses; but even with this allowance it is only the seats close to the windows that get sufficient light, and on the ground floor at least half the room is too dark (see Fig. 20), being lit chiefly by reflected light from the walls opposite,* and as the school should be at least a sufficient distance from the opposite houses to enable every pupil to be able to see at least some part of the sky, the distance between the school and the house opposite should not be less than twice the height of that building. In the regulations for school buildings in Berlin it is laid down that there should be no building nearer to the school than 60 ft.

The usual custom with regard to questions of interference with light by buildings opposite is to draw a line at an angle of 45° from the window of one building. If this clears the other building it is considered that the light is not interfered with. In "School Hygiene," Mr Shaw states that an angle of not more than 60° is required to fully satisfy the requirements of light and air.



21. PRISMATIC GLASS.

In cases of existing schools where the rooms are insufficiently lit owing to houses or buildings standing too near, the illumination of the room can be very greatly increased by the use of ribbed or prismatic glass—that is, glass made in the form of a series of prisms (see Fig. 21), by means of which the rays of light are caught and thrown horizontally into the room, instead of merely falling on the floor close to the window. It is of course necessary that the glass prisms should be so adjusted that the angle at which the light is deflected inwards by the prism should be arranged to give the best results with the angle at which the light falls upon it from the outside, the angle naturally varying with each floor. The glass is made so that it can be used with ordinary sash windows, that known as the Luxfer prism being perhaps the most successful.

In some tests made in 1900 at the Massachusetts Institute of

* Houses with plain brick fronts are reckoned to absorb from 70 to 90 per cent. of the light in reflecting.

Technology * it was found that the best results were given by factory ribbed glass, plain on one side and having twenty-one ribs to the inch in true curves, concave and convex. This, with a sky angle of 60° or less, increased the effective lighting by 50 per cent. The glass is of course set with the ribs running horizontally, unless it is fixed in a position where it is required to catch the light from an opening between two high buildings, when it is set vertically. Where a school has to be placed or is already in position in a street too narrow for the effective lighting of the rooms on the lower floors, it should if possible be arranged that only the upper floors should be used for class-rooms, reserving the lower for any purposes for which light is not so important. Cohn † speaks very strongly against the evils attending a school built in a narrow street, saying finally that the short sight in a school increases so exactly in proportion to the narrowness of the street, that if he were given the number of scholars in the school suffering from myopia he would undertake to deduce the width of the street in which the school lay.

Size and Position of Windows.—The size of the windows is usually settled by the proportion of clear glass space that should be supplied in proportion to the floor space, and this is estimated at various amounts by different authorities, but all will be found to lie between the proportion of one-fourth to one-sixth of glass space to floor space. The following list will show the different amounts demanded by various writers on the subject:—

Robson, School Architecture - - -	1 to 5.
Briggs, Modern American School Buildings -	1 „ 6.
Shaw, School Hygiene - -	1 to 4 or 6 (according to aspect).
A. Dukes, Health at School - - -	1 to 4.
Erismann - - - - - -	1 „ 5.
Cohn - - - - - -	1 „ 5.

In a list of schools given by Baginsky ‡ the proportion varies from 1 to 4 to 1 to 6, but the average would come to about 1 to 5. So that while perhaps in an open situation on the south side the proportion of 1 to 6 would be sufficient, in a place where the light had not perfectly free access, or for rooms looking north, the proportion of 1 to 4 would not be too much to ensure proper lighting during dull weather.

The amount of window surface to be supplied is sometimes given

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* School Hygiene, E. Shaw, 1901. † Lehrbuch der Hygiene des Auges, 1892.
‡ Schulhygiene, 1898.

in so many square inches per head for the pupils the room is to accommodate. Cohn gives 2,052 q.c.m. (about 2 sq. ft.) as a sufficient allowance, while Erismann raises this to 2,670 q.c.m. ($2\frac{1}{2}$ sq. ft.), but this does not seem an altogether satisfactory method of reckoning, as in the case of a larger amount of floor space than usual being allowed, the window space provided would not be increased in proportion.

According to Mr Shaw, the illumination in the darkest part of the room should not fall below 50 candle metres, a candle metre being the amount of light given by a standard candle at 1 metre's distance. This, the writer observes, is rather more than that given by Cohn. In order to ensure this amount on dull sorts of days and weather, rooms having a southern exposure should have not less than one-fourth of the floor space transparent glass. In rooms with a northern aspect it should be somewhat greater. In this country a proportion of 1 to 4 is not too much, when the number of dull and cloudy days are considered.

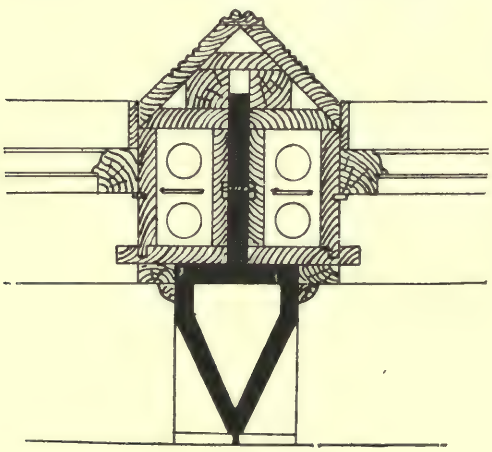
But to ensure the efficient lighting of the desks it is by no means enough to merely supply the requisite amount of glass space. The positions of the windows themselves have a great influence upon complete lighting of the rooms. As to the direction from which light should enter, all authorities are unanimously agreed that class-rooms should be lit from the left side, in order that the scholars should not be writing in the shadow of their hand. Light coming from the wall behind the master's desk should under no circumstances be allowed, for not only does the glare of the light directly in the face of the pupils cause great discomfort and injury, but they are also unable to see the master's face or the blackboard clearly. As to the admission of light from the back of the room, there is some diversity of opinion, but provided that the light admitted by such windows is neither so much nor so strong as that admitted from the side windows, *i.e.*, so that it is not strong enough to cast shadows, then as far as the pupils are concerned such light may be allowed without harm, and will add to the general illumination of the room, without causing any inconvenience. However, the teacher who has to face these windows will probably find a certain amount of discomfort, and be apt to find his eyes weakened or injured.

Of course windows placed at the back only would be extremely injurious both to pupils and teacher. In France windows opposite the teacher are not allowed, and are seldom found in Germany.

Additional lighting may be obtained, if necessary, from the right-hand side, but care must again be taken to ensure that light brought in from that side is not strong enough to overpower that from the left, and so cause shadows. The windows should be high up and not too

large. On the whole there is little question that the best way to light a class-room is to have all the windows on the left side of the room, with a small supplementary window fairly high up on the right side, or at the back of the room, and more for the purpose of ventilation to obtain a through draught than for that of light, except in the case of an unusually wide room, when it is usually necessary to get some light from the back (see Fig. 11).

In his book on School Hygiene, Mr Shaw mentions a suggestion made by Javal, and supported by Cohn, that the school-room should be lighted from above, saying that it is to be approved theoretically, but that it would not be feasible from the practical point of view. It is difficult to reconcile this with his objections made further on to the use of high sills, that by preventing the children from looking out, they invest the school-room with an irksome air of confinement. A school-room lit from the top only would be a gloomy place indeed, though in the one-story school buildings, of which there are now a certain number, it would not be difficult to carry out, but the down draught of cold air would seriously add to the difficulty of warming and heating.



22. Iron Mullion.

In placing the windows it is of great importance, firstly, that there should not be a large space of wall between the back of the room and the first window; and secondly, that there should not be wide piers between the windows. It is not at all uncommon to find class-rooms with only two windows; this necessitates, except in very small rooms, a considerable width of wall between them, and however well the room may be lit as a whole, there will be a heavy shadow cast across the room where the pier comes. It is hardly possible to construct brick piers of sufficient strength in a building of any height that will not interfere considerably with the light. In order to meet this objection, Mr R. Briggs, an American architect, has tried with success a plan of using iron mullions cast with heavy flanges or webs, with the window frames bolted directly to them (see Fig. 22). In this way it is possible to put the windows sufficiently close, and at the same time provide

sufficient strength. Where brick piers are used, a considerable gain in light is obtained by bevelling off the piers.

The height of the windows naturally depends on the height of the room, but they should always be carried up as near the ceiling of the room as constructional necessities will admit of, both for the sake of ventilation as well as that of light.

Dr Baginsky calculates that, in order to allow of the row of desks farthest from the window being properly lit, the depth of the room should be two and a half times the height of the window above the level of the top of the desks. That is to say, in a room 23 ft. wide the height of the window should be 8 ft. 10 in. high, supposing there to be a gangway of about 3 ft., which must be subtracted from the width. In Saxony it is required that the height of the window space above the level of the desk should be two-fifths of the depth of the room.

Height of Sills.—The height of the window sill plays an important part in the question of lighting. In the first place, it should not be below the level of the top of the desks, or there are likely to be unpleasant reflections from the floor; nor, on the other hand, should it be so high that the children are unable to see out. There is a dreary appearance given to a room where the window sills are too high. There is also an unnecessary loss of lighting area. Mr Robson* recommended that the sills should be at least 5 ft. from the floor and more with advantage. His object in making this suggestion is to enable the heads of the window to be brought as near the ceiling as possible, but it does not seem necessary for this purpose to raise the sills to such a height, for, unless the room is unduly high, they can be carried to the ceiling in any case. In looking at a class-room where the sills are high it will be noticed that the row of desks next the windows are completely in the shadow cast by the window sill. This can to a certain extent be obviated by sloping the sill downwards. In Germany the window sills are as a rule between 3 and 4 ft. from the floor. In some recently erected schools in Berlin the window sills are just under 4 ft. In his book on School Hygiene, Dr Baginsky comes to the conclusion that 3 ft. 3½ in. should be regarded as a minimum height.

The building regulations of the Board of Education in this country give 4 ft. as the height of the sills.

In America the usual height is from 3 ft. 6 in. to 4 ft. Mr Shaw gives 3 ft. 6 in. as the best height.

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* School Architecture, 1874.

In some recently erected Secondary Schools in this country the height lies between 3 ft. 6 in. and 3 ft. 9 in. It may, I think, be concluded that 3 ft. 4 in. to 3 ft. 6 in. is a good height. It is sometimes recommended that where the windows are low enough to allow the pupils to look out, some precautions should be taken, such as fluted glass for the lower panes, or whiting, to prevent their attention being distracted from their work. This is unpleasant in appearance, and should surely be unnecessary. The lesson must be badly given if it cannot supply a sufficient counter-attraction.

Erismann gives the measurements taken from those of his model class-room as 3 ft. to the window-sill, 10 ft. 6 in. for the window opening, and 1 ft. $7\frac{3}{4}$ in. above the top of the window. This last measurement is too large, as by means of care in construction and the use of girders, the head of the window can be brought very much closer to the ceiling. In the Sekundarschule recently erected at Zurich, the glass is carried right up to the ceiling. The foregoing remarks on lighting may be shortly stated as follows :—

1. The main light to be from the left, other windows being only supplementary, or for the purpose of ventilation.

2. That the transparent glass surface in a class-room should be if possible $\frac{1}{4}$ in. of the floor space, and should never, even on the south side, be less than one-sixth.

3. That the sills of the windows should be not more than 3 ft. 6 in. from the floor, and if higher should be bevelled off.

4. That the glass should be carried as near the ceiling as may be constructionally possible.

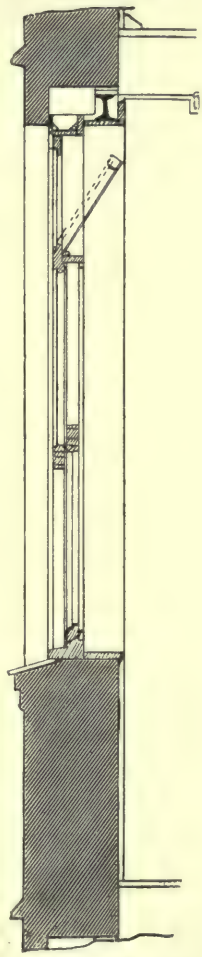
5. That the piers between the windows should be narrow, and splayed or bevelled off.

6. That the window at the end of the room opposite the master's desk be as near the back wall as possible, and in any case the distance between the back wall and the window being at least as small as the gangway behind the last row of seats.

The windows themselves should be constructed so as to allow the fullest amount of transparent glass surface. No transoms or heavy mullions should be allowed, because these are apt to cast shadows or make the lighting uneven, even though there may be a sufficient surface of glass after deducting these. It is hardly necessary to add that in calculating the glass surface it is not the window openings that are meant but actual glass surface.

The form of window that is best adapted to school use is a well-made, easy-working sash window. It is an excellent plan to make the

top part of the window open in the form of hoppers for the purpose of ventilation (see Fig. 23). For a window on this principle, which has been tried in a large number of schools and is found to work well, it should be remembered that in order to avoid down draughts it is essential to have cheeks to these hoppers. Any class-room looking to the south or west should be provided with blinds. It is an excellent plan to make these rolling upwards from the bottom, so that the window can be obscured easily up to any desired height. The glass should be as near the outside wall as any building regulations there may be will allow, both to gain light, and also to keep the glass farther from the pupils sitting near the windows.



23. A Class-room Window.

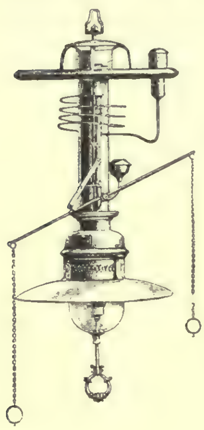
The colour of the walls has of course a great influence on the lighting of a room, for while it is obviously necessary not to put a colour which absorbs too much light, on the other hand too white a wall produces unpleasant glaring effects and is painful to the eyes, so that in selecting a colour it is necessary to select one that, while being restful to the eyes, it shall not absorb too much light. Light yellow and buff are colours often used and often recommended, but investigations point to the fact that yellows produce fatigue and nervousness to a marked degree as compared with other colours. Some shade of green seems on the whole the most satisfactory colour to use. It is restful to the eye, does not absorb light to anything like the extent of the reds and browns, and there is more resemblance in light reflected from a green surface to actual light out of doors, where at the time of year that light is strongest there is most green to be found.

German writers recommend a green or greyish green as most suitable. A light greenish grey which can be made with Antwerp blue, raw sienna, and white, will give a most pleasant result. The walls should always be painted so as to allow of washing, but the paint should be flatted in order that there should be no gloss or shine.

The ceiling should of course be left white in order that as much light as possible may be reflected from it. It should be kept flat. Any raised beam or girder has a powerful action in stopping the movement of the air, and so hindering ventilation. It is customary in Elementary Schools to paint the points of the compass upon it.

ARTIFICIAL LIGHTING OF CLASS-ROOMS.

In schools where work is carried on in the afternoon or evening, or in schools situated in large towns liable to fog, the question of artificial lighting assumes considerable importance. The requirements necessary to produce satisfactory results are obvious enough—sufficient illumination, steadiness of light, and as little vitiation of the air as possible. Any colour in the light, such for example as a strong yellow, tends to lessen the contrast between the black and white of printing or writing, and so is apt to lead to visual fatigue.



24. A Petroleum Regenerative Lamp.

Petroleum Lamps.—For schools in country places where there is no supply of gas obtainable, which are of insufficient size for the generation of their own gas or electric light, some form of petroleum lamp must be used. The recent improvement in the methods of making and using acetylene gas, which can be installed at a comparatively small cost, offer an alternative, and the methods and apparatus are described below when dealing with gas.

The usual form of hanging lamps for petroleum found in country schools are an unsatisfactory means of lighting, but as such schools are as a rule only used during the hours of daylight, it is usually when the room has to serve for parish meetings, &c., that the light is wanted. One of the strongest objections to hanging lamps lies in the shadow cast by the body of the lamp itself. There is a method of using petroleum for illumination in which not only is this difficulty got over, but by which a very brilliant light can be obtained. A lamp of this kind is illustrated in Fig. 24. They are known as "regenerative" petroleum lamps, and are much on the same lines as the regenerative gas burners described later. The heat of the lamp is used to raise the temperature of the incoming air, and to volatilise the oil. By this means a very intense light is produced, which has the further advantage that the strongest light is thrown downwards. Lately a petroleum lamp, which also burns the volatilised oil, has been invented, which is fitted with an incandescent mantle (see Fig. 25). It has hardly had sufficient trial yet to warrant its adoption in schools, though good results are claimed for it.

25. Petroleum Lamp with Incandescent Mantle, made by the Welsbach Company.

Gas.—Gas is of course by far the most extensive method of lighting at present in use, but as ordinarily installed, with flaring jets, is by no means a satisfactory form of illuminant. The light is yellow and unsteady, and when the pressure is high and the combustion imperfect, produces a very high percentage of noxious fumes. In order to provide against the constantly fluctuating pressure, there are various kinds of governors in use placed on the house side of the consumer's metre, or some kind of governor actually in the burner itself, or both are supplied. In cases where regularity of pressure is essential, such as the Welsbach incandescent lamps, it is better to have the governors at each light only. The principle upon which they are usually arranged is somewhat as follows:—There is a small chamber through which the gas flows, the inlet being partially closed by a small cone, which rises automatically and reduces the size of the inlet or fissure as the pressure increases, sinking again as the pressure grows less. Sometimes the governor is arranged with a flexible leather diaphragm, which, expanding upwards under pressure, draws up a spindle which regulates the size of the opening. Fig. 26 shows an example of a governor burner, in which the float in the centre is kept in position by means of a thin metal needle running up through it. Of course there are many varieties of governors, and as long as they are fairly free from dust and dirt, work fairly well, but all require an occasional inspection. When the float has merely stuck, tapping the burner smartly will often remedy matters, or if necessary, unscrewing the base of the burner and setting it free.

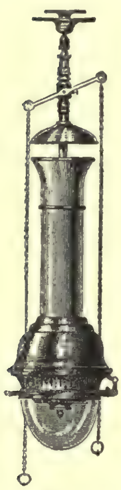
26. A GOVERNOR FOR GAS.

The Argand burners, though formerly in considerable demand, do not meet with much approval at the present day, the necessity of having a chimney to each light and the heat evolved militating seriously against their use. The principle upon which the Argand burner is based is as follows:—The burner consists of a hollow steatite ring pierced all round with a number of small holes through which the gas passes, being brought to the chamber under these holes by three small metal tubes. Air is allowed to come in through the centre of the circular flame as well as upon its outer surface. These lamps are very sensitive to variations in the pressure of gas, and should always be fitted with a governor. The light given is rather better for the amount of gas used than that of the ordinary flat flame burner.

By increasing the temperature of the illuminating flame, the intensity of the light emitted is raised proportionately. Upon this principle is based the idea of what are called regenerative burners.

The heat of the lamp itself is utilised to raise the temperature of the air before it is allowed to come in contact with the flame. "It is found that the light emitted from high-class burners of this description, such as those of Wenham or Siemens, is about three times greater per unit of gas consumed than that emitted from ordinary Argand or flat flames." *

The Siemens lamp (Fig. 27) is a very powerful form of illuminant, and it can be placed high up, as it throws most of its light downwards. Further, not only can it easily be made to carry off its fumes, but can materially assist in carrying off the vitiated air from the top of the room. It is a very excellent and satisfactory method of lighting large rooms or halls, and is used in Germany to a considerable extent in class-rooms.



27. SIEMENS REGENERATIVE GAS LAMP.

Albo-Carbon Lamps.—Albo-carbon or recrystallised naphthaline is used for intensifying the light obtainable by ordinary gas. The albo-carbon is placed in a reservoir through which the gas passes to the burner or burners, the heat of which is used, by means usually of a copper conducting rod, to melt the albo-carbon. At a temperature considerably below that of boiling water, the naphthaline vapour is given off, and mixing with the gas, greatly increases its illuminating power. It is, however, rather apt to smoke, and requires a certain amount of attention in refilling the reservoir periodically, and while giving a strong light with an economical use of gas, it does not compare favourably with the incandescent gaslight, which has to a large extent superseded it.

Incandescent Gaslight.—Though of course all light is obtained by incandescence of small particles, the word, where used in reference to gas, is generally held to mean the heating by a non-luminous flame certain substances to a state of brilliant incandescence. The practical use of this principle is due to Dr Auer von Welsbach, who in 1885 succeeded in making a commercially successful adaptation of this principle in the form of the well-known Welsbach burner. This form of lamp has been brought to a considerable pitch of perfection now, and while giving a very powerful light, is very economical in the amount of gas used, it having been found that somewhere between five and six times the amount of gas is required to obtain the same amount of light in an ordinary flat

* *The Builder*, 14th September 1901.

flame burner that is necessary for an incandescent gas lamp. A further advantage lies in the fact that, owing to the high temperature in the lamp, the combustion is more complete, and so less vitiation of the air is caused. But in spite of the many undoubted advantages of this light, it is not altogether adapted for school purposes as far as lighting class-rooms is concerned. Trouble is caused by the somewhat fragile nature of the mantles, which are peculiarly liable to damage in a school, owing to the vibration of the floor caused by the movements of large numbers, or to the strong draughts when windows are opened to get through ventilation. There is an arrangement to provide against damage by jar or shocks known as the "anti-vibration" holder (see Fig. 28), which claims to obviate any danger of breaking the mantles by jar; but while it may effect this, it unfortunately increases another drawback, which lies in the shadow thrown by these lamps on any desk immediately underneath. Where these lamps are in use, it should be remembered that the dimness which at times comes over these lamps is usually due to dust falling on the wire gauze through which the gas comes. This can be easily cured by lifting off the burner and blowing through it, care being taken not to injure the mantle. The lamps supplied with small by-pass burners save a lot of trouble, and generally ensure a longer life to the mantle. They are, however, sometimes disapproved, on the ground of their tendency to blacken the mantle, and their liability to extinguishment by draught.

28. ANTI-VIBRATION HOLDER FOR A WELSBACH LAMP.

Acetylene.—A method of illumination that has come into considerable use in the last few years is that of acetylene, and in country places and small villages, where there is no public supply of gas or electric light, is sometimes found of great use.

Pure acetylene gas is a colourless and nearly odourless gas, but the ordinary commercial form has a strong and rather unpleasant smell, which has the advantage of ensuring a fairly prompt detection of leakage.

The gas, which is produced for the purpose of lighting by the addition of water to calcium carbide in a solid condition, is in a pure state not a particularly dangerous gas, but when mixed with ordinary atmospheric air makes a highly explosive compound. But given reasonable care and a properly arranged generating apparatus, there is little more risk in its use than in that of ordinary coal gas. In illuminating power the superiority of this gas is very marked. It gives a brilliant white light of great intensity and of high actinic power, the

flame required in order to give the same amount of light being relatively much smaller than that of an ordinary flat gas flame. The illumination given by burning 1 cub. ft. of acetylene per hour is given as 32 candles, gas giving in an ordinary flat flame only 2½ candles. In regard to vitiating effects on the air in the room, this light compares very favourably with other forms of illuminants, as the following table, drawn up by Professor Lewes, shows:—

COMPARATIVE HYGIENIC EFFECT OF ILLUMINANTS PER UNIT OF LIGHT.

	Carbonic Acid Evolved.	Moisture Evolved.	Oxygen Removed from Air.	Heat Produced.
Acetylene	100	100	100	100
Coal gas, flat flame	480	1,470	520	795
Coal gas, mantle	45	230	62	87
Petroleum, large lamp	995	700	498	246

The calcium carbide from which the gas is generated is produced by the combination of lime and carbon under the influence of great heat generally in some form of electric arc furnace. There are many different forms of generators for the purpose of decomposing the carbide by means of water; either by dropping the solid into water, by allowing the water to rise to it, or by allowing water to drop upon the carbide. The important point to be guarded against is the rise in temperature that occurs during the generation of the gas. For this reason the forms of generator which allow water to drip or be sprayed over the carbide are to be avoided. Where the carbide is dropped into a considerable quantity of water cool generation can be ensured, but owing to the solubility of acetylene in water there is a certain amount of gas lost. The carbide is usually soaked in petroleum before use in order to retard the action of the water and prevent too rapid a formation of gas. In any case the best results are only to be ensured by having a careful and intelligent man to take charge of the apparatus. The additional cost incurred by having an apparatus for cooling and purifying the gas, as well as a small gasometer so that the gas can be always ready, is repaid by the improvement in the working of the light.

It is generally reckoned that the cost of the installation and supply of acetylene is about equal to that of gas when the price of that is about

3s. 6d. per 1,000 ft., but probably this is too low, and in an article in *The Builder* the writer maintains that it is not advisable to put in an installation of acetylene, at any rate for domestic lighting, where gas is procurable at a cost of under 5s. per 1,000 ft.* The initial cost of installation is not great including all the generating apparatus, probably about 15s. to 20s. per light for an installation of not less than 100 lights.

I have not been able to see or even hear of any school where this method of lighting is actually in use, but owing to its high illuminating power and slight effects in the deterioration of the air, and the comparatively low cost of installation, it would seem that it might be tried with great advantage in schools.

Electric Light.—The incandescent electric light has so many advantages in its immunity from danger of fire, absence of heating, or vitiating effects, and in steadiness of light, ease of control and freedom from dirt, that it is being almost universally adopted wherever possible for every sort of building. In spite, however, of its many advantages, it is exceedingly difficult to arrange it so that there will be a really efficient light for working, and in lighting a class-room considerable care is necessary in the arrangement if a satisfactory result is to be obtained. It is sometimes objected against it that the light is rather inclined to be yellow, and that the glowing filament throws a kind of line on the book immediately under it. The flattened globular lamps with the upper parts silvered are particularly bad, as they throw a shadow of the filament in a peculiarly unpleasant way. The use of ground glass globes takes off about 50 per cent. of the light.

Speaking generally, most of the complaints and dissatisfaction arising from the use of electric light are due to an insufficient supply of lamps, or to the use of lamps of too low a candle-power. Incandescent lamps have the peculiar property of making a room seem thoroughly bright and well lit, until it becomes necessary to read or write. The discomfort then felt is usually attributed to the quality or kind of light when really due merely to the want of more powerful lamps. This is to a large extent due to the fact that an electric lamp, while appearing bright, does not seem to have a great power of diffusion. In arranging the lights for a class-room it cannot be too strongly borne in mind that there should be a most liberal supply of lamps, and those of fair candle-power, and not hung too high up.

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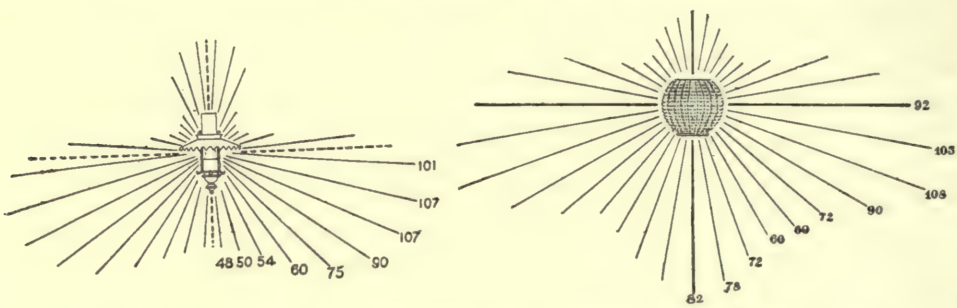
* *The Builder*, December 1901.

Shades and Globes.—Shades are used either for the sake of producing a greater diffusion of the light, or to prevent the irritation caused by a naked flame if of any great degree of intensity. Of course any shade must obstruct some proportion of the light, but as they may be arranged to direct rays downwards which would otherwise be wasted or to cause greater diffusion, the actual result may be a better illumination where required than is given by the open flame. With ordinary gas burners, a ground glass globe stops from 18 to 23 per cent. of the light in a horizontal direction, the proportion of light obstructed growing less as the intensity of the light is increased. In the case of class-rooms, the lighting is of course always from overhead. In the case of open flames, the direction of the strongest light is horizontal, and with ordinary flat flame burners the light in a downward direction is at a certain elevation, and within a certain radius increased by a globe shade, clear glass



29. Diagram showing the Direction of Strongest Light with a Plain Lamp and a Holophane Globe.

increasing it 6 per cent., ground glass about 9 per cent., while albatrine and opal globes will increase it as much as 20 per cent. by reflecting light downwards. The globes should always have a wide opening at the bottom. The narrow-necked globes induce a draught which causes a good deal of flickering.

Another form of globe which has recently come into use is the Holophane globe. Great powers are claimed for this invention in the direction of improved diffusion of the light, Mr Edward Shaw, in his work on School Hygiene, speaking very highly of it. The globe is made usually of clear glass. On the outside are horizontal prismatic lines, while on the inside the prisms run vertically. The outside horizontal prisms direct the light downwards, while the vertical prisms inside spread the light evenly over the shade. In this way the effectiveness of the light is very largely increased in the direction where it is most valuable, *i.e.*, below the horizontal. The diagram (Fig. 29) shows

the relative proportions of light in different directions between an ordinary flat burner with naked flame, and one with a Holophane globe. These globes can be used with any kind of light, and give excellent results with a Welsbach burner. The light on the desks in a room can of course be very largely increased by the use of reflectors. They should preferably be made of thin porcelain or opal, which will increase the downward light by as much as 60 per cent., and should be made with as flat an angle as possible. Metal or mirror reflectors, of course, are far more effective, but could hardly be used in a room owing to the glare.

Amount of Light required and Position of Lamps.—It is not very easy to say what constitutes efficient illumination, and there is perhaps nothing more difficult to judge of by mere inspection. There are, however, various instruments for the purpose of measuring light known as photometers, the amount measured being usually expressed in terms of so many candle-power for the convenience of comparison, the various forms of illumination being reduced to this standard.* The proper diffusion of the light, again, has an important bearing upon the amount necessary. Where the light is derived from one point, or where there are bright points that catch the eye, the value of the light for the purposes of work will seem actually less than in a room where the light, though not so strong, is well diffused. This is due to the involuntary contraction of the pupils, caused by looking at a bright point, which reduces the amount of light entering the eye. For this reason a frosted electric lamp will, under certain conditions, seem to give a better light than one of the same candle-power with clear glass.† As far as possible unprotected lights should not be tolerated in a class-room. Where the lighting is well diffused and well placed, there will be an absence of strong shadows.‡

It should not be forgotten in estimating the amount of candle-power required, that the strongest light is usually found in a horizontal direction from its source, so that while a sufficient candle-power is supplied to make the room thoroughly light, the illumination in parts

* The standard for this purpose is the light emitted by a spermaceti candle of known composition, burning at the rate of 120 grains an hour.

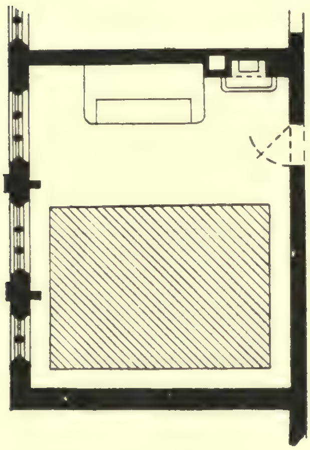
† Frosted glass is usually reckoned to stop from 30 to 50 per cent. of the light.

‡ Mr Fleming in "Electric Lamps and Electric Lighting," suggests a rough test of the distribution of the lights—take a white card or sheet of writing paper, hold it horizontally about the level of the eye, then hold a pencil or other small rod vertically on the card, it can then be easily seen if there is a strong shadow in any direction.

where the light is actually required, may be far below the requisite amount.

The amount of lighting necessary is again, to a large extent, dependent upon the colour and the surface of the walls. The following table, giving some of the results of investigations made by Dr Sumpner, will show the great variation in different colours :—

Yellow wall paper	reflects	40	per cent.	of the light	falling	on it.
Blue "	"	25	"	"	"	"
Dark brown wall paper	"	13	"	"	"	"
Deep chocolate "	"	4	"	"	"	"
Plain deal (clean)	"	40 to 50	"	"	"	"
Plain deal (dirty)	"	20	"	"	"	"
Yellow painted wall (clean)	"	40	"	"	"	"
Yellow painted wall (dirty)	"	20	"	"	"	"



30. Showing the Disposition of Seats in a Class-room. From an actual Building.

In arranging the position of the lights, whether electric light or gas, the arrangement of the desks should be first determined. When, as is commonly done, the fitter is instructed to fix a certain number of points, he is apt to dispose them symmetrically over the ceiling, with the result in many cases that much of the light is wasted. For example in Fig. 30, taken from an actual building, there would be a large amount of light wasted in lighting the unoccupied space in front of the desks. In Germany great care is usually taken to concentrate the light over the desks, and to make it come from the left to correspond with the light during the day. A special light arranged to light the blackboard will be found an advantage.

Number of Points and Amount of Candle-Power required for Gas.—As class-rooms do not vary to any great extent in height, it is a convenient method of reckoning to consider how much candle-power is required for a certain area of floor space. In some figures published for various classes of buildings by Messrs Stott, 300 candle-power for 1,000 square feet of floor space is suggested for schools. This is almost the same amount as that demanded by Mr Grafton,* who remarks that for class-rooms not much over 12 ft. high, a useful

* A Handbook of Practical Gasfitting, 1901.

rule is to provide one candle-power to every 3 sq. ft. of floor space, the lights being placed about 8 ft. from the floor. This, provided that the walls are not dark, will provide an excellent illumination, somewhat in excess of that usually found. This means that in a class-room, measuring say 30 by 20 ft., that twelve of the ordinary fish-tail burners would be required, or four Welsbach incandescent lamps. A form of double incandescent lamp that has been found very satisfactory for school work is shown in Fig. 31. It should have an opaque white guard as well as the reflector, to shield the light from the eyes of the pupils.

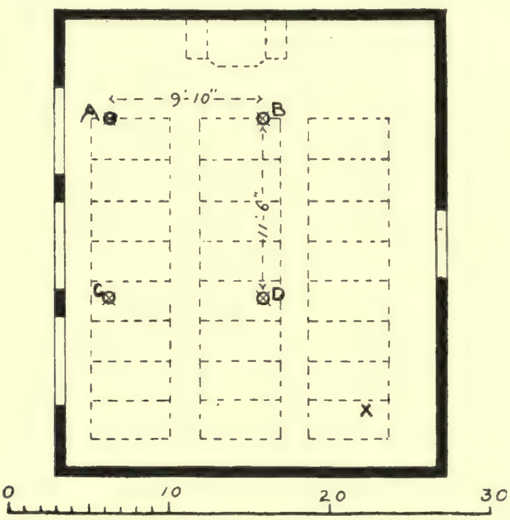
31. A Double Welsbach Lamp.

The following table, quoted in a series of interesting articles on gas lighting that appeared in *The Builder* during 1901, gives the results of some experiments made by Major Scott-Moncrieff on the lighting of barracks. The room in which the experiments were made was 40 ft. long and 20 ft. wide. The lights were placed at 8 ft. from the floor, and the illumination was judged by means of photometers, at a height of 2 ft. from the floor, so that the results would give a fair suggestion for a class-room of a similar size. The top of a desk would be of course a little higher.

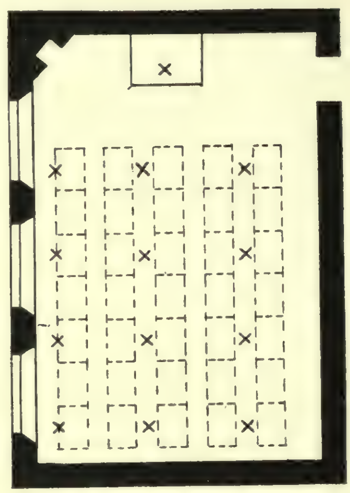
Illumination of a Barrack-room, 40 ft. by 20 ft., at a Height of 2 ft. above the Floor.

Description of Burner.	Total Gas Consumption per Hour.	Illumination.
	Cub. ft.	
Two Bray burners	16	Whole room insufficiently lighted, nowhere possible to read small print 6 ft. below gas lamp.
Two flat-flame burners fitted with caps	11.4	About one-quarter the working space illuminated.
Two Stott-Thorpe reflex lights	18	Eight-tenths of working level efficiently lighted.
Two Sugg's workshop lights	16	About one-quarter the working space efficiently lighted.
Siemens regenerative	11	Whole room well illuminated.
Diemel regenerative	9	Two-thirds working space efficiently lighted.
Two Schulke lamps	10	Practically whole working space illuminated.
Welsbach incandescent, with glazed conical reflector	4.3	Whole room brilliantly lighted.

The results of this are strongly in favour of the incandescent gas lamps and the Siemens regenerative lamps. The former light has been discussed in this connection before, and the disadvantages pointed out, but provided proper care is taken with shades and reflectors, these can be sufficiently overcome for practical purposes. The Siemens regenerative lamp is admirably adapted for lighting large rooms, gymnasia, and halls. It can combine with the light considerable ventilating power, as has been already pointed out. The initial cost is, however, rather high, and it requires cleaning occasionally. In Germany it is used to a considerable extent for class-room lighting, great care being taken in the exact position of the lamps, so that the light shall approximate



32. Diagram showing Positions for Four Siemens Gas Lamps.*



33. Diagram showing Positions of Electric Lamps.

as closely as possible to that of daylight, and come from the left of the pupils.

The diagram (Fig. 32†) given above shows a suggested method of lighting a class-room with this form of lamp. The room measures 29 ft. 6 in., and is intended to accommodate 48 scholars. The distance from the teacher's desk to the front row of seats is about 6 ft. 6 in. The lighting would be provided by means of four of these lamps at the positions A, B, C, D, hung at a distance of 9 ft. from the floor—which would be about 6 ft. 6 in. above the level of the tops of the desks.

* From Schulhygiene, Baginsky, 1898. † From *ibid.*

It is urged that with the smallest of the standard sizes of Siemens regenerative lamps the room will be adequately lit, the lighting being arranged to come from the left, so that while the seat marked with x is the farthest possible from any lamp, it is well above the minimum standard of light necessary for reading and writing. Welsbach burners or acetylene lamps placed in this way would provide an excellent illumination for a class-room.

Number of Lamps required for Electric Light.—In the case of electric incandescent lamps, it is of great importance that there should be a large number of lamps in order to make sure that the light will be well distributed. As regards the actual candle-power, it should certainly not be less than for gas, for, as remarked above, electric light does not seem to carry well, and further, the effective light of the lamps decreases after they have been in use for a short time. One 16 candle-power lamp to every 50 sq. ft. of floor space will give a satisfactory illumination. It certainly should not be allowed to fall below this amount.* That will allow for a class-room, 30 by 20 ft., twelve 16 candle-power lamps. These would probably be placed in pendants of three lamps, but much more satisfactory diffusion will be obtained by distributing them singly, so arranged that no lamp is more than 6 ft. from the one next to it. Fig. 33 shows a suggestion for the arrangement of the lamps to ensure good and effective illumination. A lamp that can be raised and lowered is placed over the teacher's desk or table.

Another method of lighting which has been tried to some extent in Germany is that of indirect lighting, in which the light is thrown on to the ceiling, and is so reflected in a pleasant and diffused form all over the room. It is of course necessary to have a very strong light, an electric arc being usually employed to ensure there being sufficient light in the room for work.

There should be one gas light or one electric light in each room that can be turned on for the purpose of cleaning, without having to use the others at the same time.

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* Electric Lamps and Electric Lighting, J. A. Fleming, London, 1899.

Chapter VIII.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

ROOMS FOR THE TEACHING OF NATURAL SCIENCE AND ART.

Scope of the present Chapter—School Laboratories as compared with those of Technical Institutions—Objects of Science Teaching—The "Heuristic" Method—The Equipment of a Room necessary for this Method of Teaching, and Apparatus—Number and kinds of Rooms required, and their Purposes—The Grouping of the Different Rooms—**Chemical Laboratories**—Arrangement, Lighting of, and Position of Benches—The Working Bench, and its Dimensions—Shelves and Cupboards—Fume Closets, Details of and Examples—Small Fume Hoods—Lockers—Sinks—Wooden Troughs—Waste and Drainage—Examples of Laboratories—Cowper Street Foundation—Birmingham High School—Felstead School—**Physical Laboratories**—Requirements of—Biological Room—Lecture Room and Demonstration Table—**Studios**—Size required—Lighting of.

The arrangement and fitting up of laboratories for advanced chemical work such as are found in the large technical institutions lie beyond the scope of a book purporting to deal with schools, and the following chapter does not propose to do more than to try and show with some illustrations the kind of laboratories and arrangements that are now expected in any good Secondary School.

There has arisen in recent years so strong a feeling that natural science should form part of the ordinary curriculum that no school can now be considered complete that has not facilities for the purpose of teaching science. Since its chief value lies in the training it gives to the habit of accurate observation and in arousing the reasoning faculties, it is necessary that the pupils should not only see the experiments done, but actually perform them for themselves. For this purpose it is necessary to supply laboratories of considerable size, in which a large number of pupils can carry on experimental work at the same time.

But while all the masters and governing bodies have readily agreed to the desirability of teaching natural science to some extent,

there is no agreement as to exactly what should be taught; what is the best method of arranging a school laboratory; or how much it is necessary to provide in the way of apparatus, &c.; and since most teachers of natural science have their own views on the subject, the more inquiries that are made the more difficult it becomes to find any common basis of agreement. Science teachers are sometimes liable, in their enthusiasm for the subject, to lose sight of the educational object of the teaching of science, in trying to cram too much knowledge into the pupils in order that they may do well in examinations, rather than to train them in method and observation; and so by doing work more advanced than is really necessary, they require elaborately equipped rooms and expensive apparatus; whereas for the majority of the boys and girls who learn natural science the real benefits may be gained without any very great acquisition of chemical knowledge and without elaborate machinery. They can, it is argued, be equally well induced to use their brains and train their observation on the simpler sort of experiments. Where there are boys and girls preparing for natural science scholarships, &c., at the Universities, the case is different, and good and well-equipped laboratories are essential. For the many boys and girls who learn natural science without any idea of going on with it after leaving school, it is not necessary to have any very elaborate arrangements. Unfortunately there is often a feeling that unless there is a splendid laboratory, well fitted up, there is no chance of doing any proper science teaching. The tendency of this is to make such teaching appear as a luxury beyond the reach of a school which has not a fair command of money. So it often happens that the laboratories in schools are much too apt to be merely copies, as far as the money can be provided, of those found in the large science colleges. Such laboratories, though erected with great expense and care, and excellently adapted for advanced chemical work, are often not as well fitted for teaching elementary classes, for which the essential requirements are plenty of room and easy supervision. It may often happen that a laboratory will better suit school requirements where there are one or two benches fitted for advanced work, involving quantitative analysis, &c., while the greater part of the room can be arranged more simply for elementary work.

In the second volume of the Special Reports Professor Armstrong gives an account of what is required for the teaching of elementary science on the "heuristic" * method, of which he is so

* The heuristic method implies teaching in which the pupils find out things for themselves by deducing them from the experiments.

strong an advocate, laying great stress upon the fact that elaborately arranged rooms are not necessary. The following account of what is required in the way of arrangement is drawn from that article.

There should be ample room provided. Benches of the kitchen table type, but which need not be fixed, suffice for nearly all purposes. These must be provided with gas but not with water; one or two long sinks made of wood—elongated washing-tubs—and conveniently situated, being sufficient to meet all the requirements of a large class; more are only provocative of endless trouble and untidiness, due to constant spilling of water. In most schools, together with movable benches such as have been referred to, it will be desirable to provide one or more benches fixed against the wall of the room, having cupboards fixed in the space underneath. Four cupboards may conveniently be constructed in two tiers under the length of bench provided for a single worker. A tray which will slide in and out may with advantage be fitted at the top of each such cupboard. It is quite unnecessary to construct the bench tops of expensive hardwood, any well-seasoned wood will suffice; but whatever the wood, it should be made impervious to water, acid, &c., by ironing in paraffin wax.

As operations involving the production of unhealthy or unpleasant fumes need very rarely be conducted, a single draught cupboard is sufficient. This may conveniently be fixed behind a long narrow demonstration table placed on a raised platform at one end of the room. A considerable amount of the wall space behind this table should be converted into blackboard by pinning against it on a light wooden framework the specially prepared black canvas sold for this purpose.

As to apparatus, it should be gradually provided to meet requirements as they arise, and every effort should be made to utilise ordinary articles—medicine and pickle bottles, jam-pots, saucepans, &c.—and to construct apparatus as far as possible in the room, for which purpose a small carpenter's bench might be provided. "Infinite injury is done at the present day, invaluable opportunities of imparting training are lost, by providing everything ready-made." * But certain things must be provided, such as foot-rules, T-squares, and set squares, and most important of all for the heuristic method of teaching, proper balances, which should be kept under cover when not actually in use.

Such is the arrangement and apparatus necessary for Professor

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* The Heuristic Method of Teaching, Prof. Armstrong, Special Reports, vol. ii., pp. 389-413.

Armstrong's method of teaching science, and it must be a poor school that cannot make some shift to teach natural science in this way.

Rooms required. — The ordinary school equipment for the purpose of teaching natural science consists of a separate laboratory for practical work in chemistry and in physics, a small well-lit room for balances separate from but in close connection with the chemical laboratory, and a store-room to each. A lecture-room common to both is almost a necessity, and in addition to these a small room that can be easily darkened for optical experiments. At Bedford Grammar School this has been ingeniously obtained by making use of the space under the rising tiers of seats in the lecture theatre.*

It is now possible for students who intend to take up a medical career to undergo their first year's training while still at school, provided that there are proper facilities for teaching the necessary subjects in the school. In order to meet the requirements of these students a room for the purpose of teaching biology has to be added to the foregoing. A biology room is of course often found in schools where there is no intention of training pupils for a medical career.

In many schools a small additional chemical and physical laboratory, where a few advanced scholars can do special work, and for the use of the science master, will be found a great convenience. A small room should be provided for the senior science master or mistress for clerical work.

Grouping of Rooms.—The above rooms should if possible be arranged together in a group. The plan of separating the chemical from the physical laboratory by means of the lecture-room (see Fig. 36) has several advantages. Apparatus for demonstration during lectures has not to be carried any distance. A class can pass easily and quickly one to the other, while the passage or corridor can often be so arranged as to come under the higher rows of seats in the lecture-room and so economise space.

The plan of devoting the top floor of a school building to the purpose of science has much to recommend it. By means of top lights not only can excellent lighting of the room be ensured, but it enables all or nearly all the wall space to be utilised for the purpose of shelves and cupboards. This is of no small advantage in a chemical laboratory, where there seems to be always a demand for more shelf space, however large the initial provision. Effective ventilation is again easier

* The same plan has been made use of in the Birmingham Technical Institute.

to manage. The disadvantage of such a position is chiefly felt in the physical laboratory, owing to the difficulty of providing tables sufficiently steady and unaffected by vibration to allow of delicate experiments; but while this objection would be fatal in the case of an institution where very advanced or original research work were being carried on, it is possible by taking precautions to obtain quite sufficient steadiness for ordinary school work.*

Chemical Laboratories: General Arrangement.—The main requisites in a chemical laboratory are plenty of room for the students and ease of supervision for the teacher. The position of draught cupboards, reagent shelves, waste receptacles, &c., should be so arranged as to reduce the necessary moving about to a minimum.

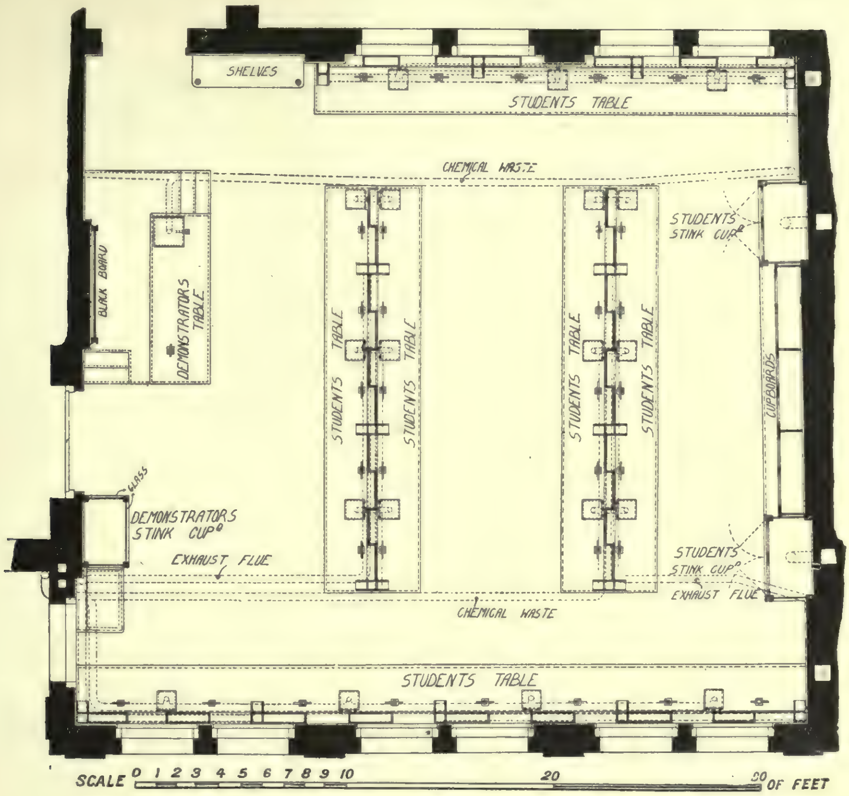
For the purpose of lighting, the working benches may be arranged so that their greater length is at right angles to the wall in which are the windows. In this way the light will be least interfered with by those working at them. It is usual in addition to the benches in the middle of the room with pupils working both sides to have a single row against the walls. Objections are sometimes made to the latter system on the ground that it is difficult for the teacher to see what the students at those benches are doing, as they have their backs to him and so hide their work, while inspection of cross benches is easy to any one walking down the room.

A demonstration table on a raised platform, and fitted with gas, water, and a down draught fume closet for the teacher, is commonly placed at one end. This is indispensable in cases when there is no separate lecture-room. Behind the table should be a large blackboard hung with the Kelvin patent counterweights, so that it can be easily run up and down. It should be possible for all the students in the room to be able to see the demonstration table without having to move from where they are working.

A question upon which there is considerable difference of opinion is as to the advisability of placing in the laboratory itself a number of desks to seat say thirty or forty pupils for the purpose of giving a collective lesson in cases where there is no lecture-room. When the laboratory is small and there is any pressure upon space it is probably better to omit them; but provided the room is large, they will not in any way interfere with the use of the laboratory, and most teachers

* There are some very valuable suggestions as to the arrangement and relative positions of science rooms in a paper read to the Architectural Association on the Design of Technical Schools by Professor Garnett on 15th January 1892.

speak strongly in their favour, as many lessons can be as well given to forty as to ten. The absence of seats makes it necessary, perhaps, to give the same lesson twice over to the pupils in their places at the benches, which is, on other grounds, not considered a desirable arrangement, since it usually involves their standing. The difficulty is sometimes met by placing the working benches across the room with pupils placed only on one side of them, so that they are all facing the teacher's



34. Chemical Laboratory, Cowper Street Foundation School. For Thirty-four Students.

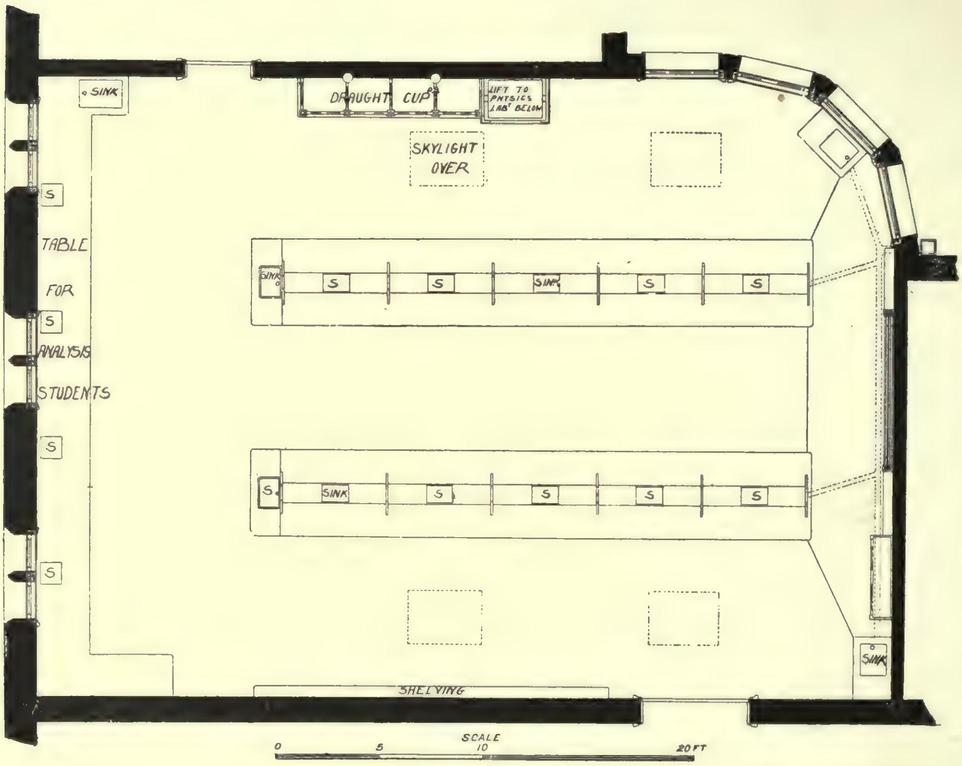
H. Chatfield Clarke, Architect.

demonstration table. The benches in this case are made narrow, and stools are provided so that the students can all listen to a demonstration table without turning round in their places.

If the benches run the long way of the room, since it is necessary to pass up and down behind those working, it is essential to have the gangways of considerable width, for those at work may at any time take a step backwards at the moment some one is passing down the

room, or in other ways collisions will be frequent, and may cause disastrous results.

The chemical laboratory illustrated in Fig. 34 is that of the *Cowper Street Central Foundation School for Boys.* This is a large and excellently equipped laboratory, very carefully arranged. The room measures about 35 by 32 ft., and provides accommodation for thirty-four students, giving a gas-jet to each, and a sink and small fume hood to every pair of students. There are two large draught closets



35. Chemical Laboratory, The High School for Girls, Birmingham.

J. A. Chatwin, Architect.

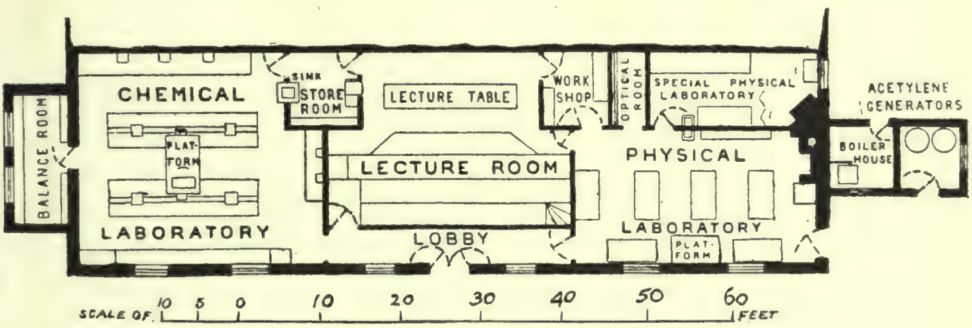
for the use of the students, and another for the master close by the demonstration table, placed on a raised platform at one end of the room. The arrangements of the exhaust flue and waste pipes are shown on the plan. Each student has a set of the usual reagents placed on shelves immediately above his working place.

Fig. 35 shows the laboratory at the Birmingham High School for Girls. The arrangement of the benches, which are fitted with wooden troughs, is fully described below. The teacher's desk comes close to

the end of the working benches; this makes it possible to take the waste pipes from the benches to the hall, underneath the raised platform, leaving the floor intact, movable boards being arranged so as to provide easy inspection.

There is one bench arranged especially for students who are doing work in analysis. Four fume closets are also provided which are illustrated below. A convenient feature is a lift connecting this room with the physical laboratory below. The floor of the room is covered with red paving tiles, open wood-work stands being provided for the pupils to stand upon. This floor has a pleasant appearance, and while easily washable, is not much affected by acids.

In Fig. 36 are shown the laboratories recently erected at *Felstead School.* The arrangement of the rooms was schemed by Mr Munby, the senior science master, and shows several ingenious methods for making the most of every inch of room. The building is practically



36. THE NATURAL SCIENCE BLOCK, FELSTEAD SCHOOL, ESSEX.

divided into three main rooms, a lobby under the upper part of the lecture-room giving access to both the chemical and physical laboratory, making it also possible to get from one to the other without passing through the lecture-room. The position of the store-room and workshop should be noticed, it being a considerable advantage to the teacher to have his store-room close at hand in case anything should be forgotten. It also utilises the space between the end of the lecture table and the wall, which of course is not available for seats.

The chemical laboratory can accommodate twenty-six boys, allowing 3 ft. 6 in. for each student, there being two double benches and two wall benches in addition to a special bench 18 ft. long for special work, such as distillation, &c., having at each end a fume closet. The working benches are supplied with small fume hoods as described above. The suction draught for these as well as the larger draught

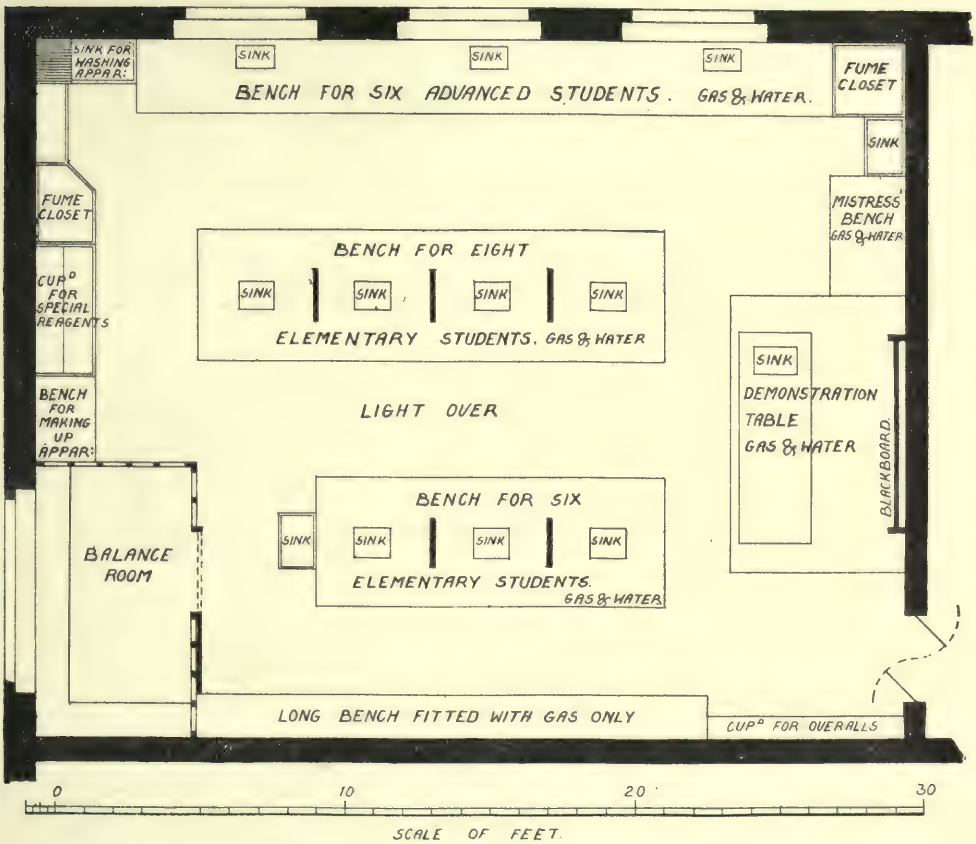
closets is obtained by arranging the ducts so that the furnace which warms the building can only draw the amount required for combustion through these openings. A novel feature in this laboratory is the arrangement for the master's table. This is arranged on a platform placed across the benches in the middle of the room. This position gives a commanding view of what every boy in the room is doing, as well as being easily seen from all parts. The balance-room is at the end divided by a glass screen, so that this also can be overlooked from the platform. The arrangement can be seen in Fig. 37, with the table and revolving chair *in situ*. In this laboratory acetylene gas has

37. Interior View of the Chemical Laboratory, Felstead School.

been in use for the last six years for ordinary experimental work, there being no possibility of obtaining ordinary gas. It is used in a special burner designed by the science master, Mr Munby, admitting air in order to get rid of the luminous effect, somewhat on the lines of a Bunsen burner, but possessing some special features. Its heating power is about double that of the ordinary Bunsen burner.

Fig. 38 shows a suggested form for a chemical laboratory for school work, arranged so as to allow of easy supervision. The two benches in the centre are intended for elementary work, and are directly under the eye of the teacher. The basins are in the centre, so that it would be possible to double the numbers at these benches, and put four

pupils to a sink, giving them 2 ft. apiece. The room would be of a sufficient size to accommodate twenty students at an examination under the regulations of the Science and Art Department. The centre benches would have one shelf only, raised a foot above the bench. The bench along the wall would be fully fitted for six advanced pupils. The balance-room is formed by glass partitions in the laboratory itself, and so all work done in there is under easy observation from any part of

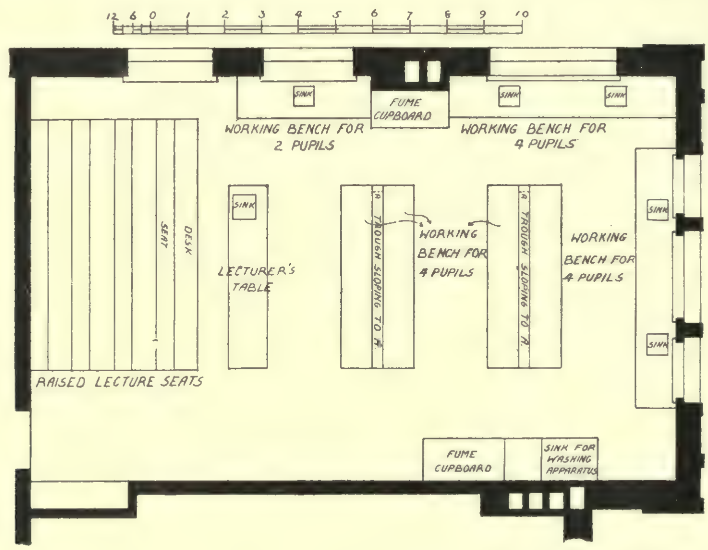


38. A Suggestion for a School Laboratory, to take Twenty Students.

the room or from the teacher's platform. The rest of the arrangement can be easily seen from the plan.

A chemical laboratory arranged with seats for lecturing purposes, as well as benches for practical work, is shown in Fig. 39. This is the laboratory at the Clapham High School for Girls now being rebuilt for the Girls' Public Day School Company. The arrangement of the room was suggested by Miss Lees, the science mistress at the school.

The nominal accommodation of the room for practical work is eighteen, but when required the numbers at the benches in the centre can be doubled. These benches are fitted for elementary work, and have a trough down the centre formed of wood treated with tar. The wall benches are reserved for students doing advanced work. The seats will accommodate forty pupils for a demonstration lesson. This arrangement of course precludes the use of a fixed blackboard behind the lecturer's table. An additional bench could be placed along the unoccupied wall.



39. The Chemical Laboratory, New School for Girls, Clapham.
The Girls' Public Day School Company.

Size of Room.—The size of the room required depends of course upon whether the school is large enough to have more than one science teacher. It is generally considered that one science teacher can look after twenty pupils doing experimental work. The regulations of the Science and Art Department give twenty-five as a maximum for one teacher. In order to take twenty pupils comfortably, allowing plenty of room for cupboard space, demonstration table, &c., the room should be not less than 20 by 30 ft. It is found that laboratories can be most economically built when they provide accommodation for multiples of twenty.*

* Technical Institutes, Paper read to Architectural Association, S. H. Wells, *The Builder*, 15th February 1896.

Working Benches.—The benches when placed across the room are arranged so that pupils can work on opposite sides facing each other. The advantages of this arrangement are economy in fittings and gain in space. The shelf for reagents can also be put where two students can use the same set. It is open to the objection that it makes an explosion or accident more dangerous. A partition which would obviate this is very inconvenient, as it hides the work of the pupils from the teacher. The plan of having a partition of strong plate glass has been successfully tried in a number of laboratories, and is highly spoken of. Unless of fairly thick glass there would be considerable liability to breakages.

Before the best method of fitting up the benches can be determined upon, it is necessary to settle to what degree the chemical teaching is to be carried. For instance a very simple form of bench will suffice for a school where few of the pupils will proceed to analysis, this branch of work not occupying so prominent a position in a beginner's course as was formerly the case. For example, at the South-Western Polytechnic, Chelsea, they have benches arranged for four students, with a plain top, and while a gas-jet is supplied to each pupil, there is one tap for water, and a sink placed at each end, which serves for two pupils. There is no partition in the centre but a row of white glazed tiles on which to stand bottles. This arrangement, while answering for very elementary work, would hardly be sufficient for a school where there were any number of rather more advanced pupils. The arrangement of sinks at each end is not altogether a good one, as it does not allow of spilt liquids being swept in, in case of an upset. In school-work where different sets of boys have to use the laboratory at different times, the sets of reagents must of course be common to the boys who use the stands in turn, so that it is impossible for each boy to have a set of his own, for the purity of which he is responsible. This obviates the need of supplying any arrangements of locking bars, &c., for the reagent shelves.

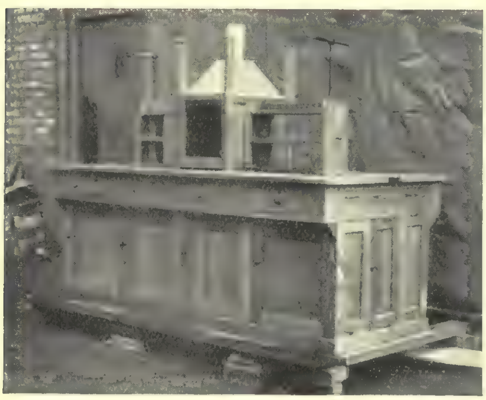
Width.—In calculating the size of the bench, it is usual to allow a distance of 3 ft. 6 in.* for each student for a school laboratory; this would be increased to 4 ft. 6 in. for older and advanced scholars. A sink with a water tap is placed midway between two students for their common use, a gas-jet being necessary for each place. In the double benches with pupils working each side a sink placed in the middle will serve the purposes of four pupils.

* This is the distance suggested by the Science and Art regulations.

Depth.—The bench should not be of too great a depth for an ordinary pupil to reach easily from back to front, say 2 ft. 3 in. or 4 ft. 6 in. for a double desk.

Height.—The bench should be sufficiently low to allow the student carrying on ordinary operations, such as filtering, &c., without having to raise his elbow much above its natural position. This would be for school laboratories 2 ft. 9 in. to 2 ft. 10 in., 3 ft. being usually reckoned for adults. The benches should not be less than 4 ft. 6 in. apart, so as to allow of a person passing easily between the backs of students working back to back at neighbouring benches.

The shelves to hold the reagents in common use are of course most conveniently placed over each stand at the working benches, and should be about 6 in. wide and 9 in. apart. They are, however, sometimes placed at the end of each bench so that one set, or one at each end, will suffice for all the students working at that bench. In the cases of benches for elementary work, one shelf raised a foot or 15 in. above the desk on brackets will be quite sufficient, and will allow of easy inspection across the benches. The shelf should have a raised bead each side to prevent the bottles being pushed off. It is a convenience to have either in the laboratory or in the store-room a shelf that will take a good number of large bottles for the purpose of holding solutions of known strength sufficient to last a year or eighteen months, as these are often troublesome to make up. Fig. 40 shows an arrangement for a working bench for four students arranged with a fume closet in the middle. In Fig. 41 are shown details of the benches in the laboratory illustrated above, Fig. 34. These benches are very fully fitted. A small fume hood A is provided for each pair of students. The shelves for reagents are arranged alternately each side. The wastes discharge into an open channel (see section, Fig. 41, A), while an exhaust flue is taken through all the benches (Fig. 41) to provide for the draught hoods.

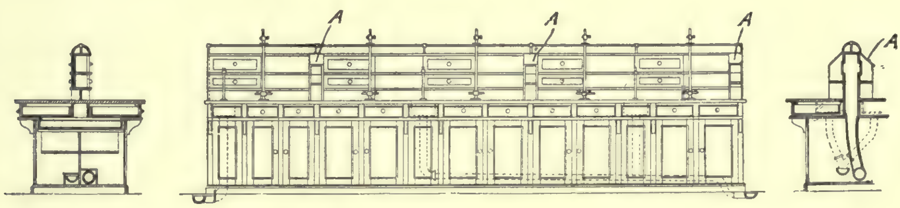


40. A Working Bench for Four Students, with Fume Closet in the Centre.

There should be in every laboratory a plentiful supply of cupboards

and shelves of considerable size, and the shelves should be a sufficient distance apart vertically to allow of large apparatus being placed upon them. The cupboards should not come right down to the floor, but leave a small space under for the purpose of cleaning. When, as is usual, the lower part of the benches are filled in with cupboards, it is as well that a space should be left under each bench for a rubbish basket, as the less distance it is necessary to carry broken glass, &c., the better. Wicker baskets with strong handles and lined with tin serve the purpose well, and are light to lift. A strip of glass arranged to fit the shelves on which the reagents stand will add much to the clean appearance of the laboratory.

The material used in making the benches is either deal or pitch pine, but there is considerable difference as to the most suitable material for the top of the working bench. Whatever is used, it need hardly be said, should be as durable and impervious as possible, as far as

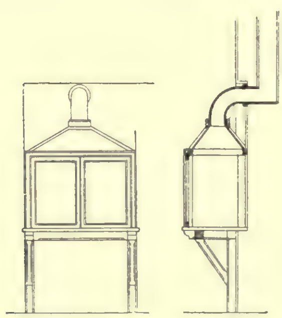


41. Details of Working Bench from the Chemical Laboratory in Fig. 34. a, Small Fume Hoods.

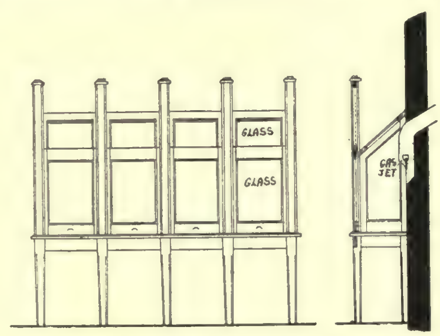
possible non-absorbent, and not liable to shrink or crack when exposed to the heat resulting from the use of burners employed in heating flasks, &c. Teak is probably far the best material, but is really a needless expense, as deal or American basswood properly treated will answer the purpose well. The top must be thoroughly waxed. Paraffin wax should be used for this purpose, as ordinary oil and wax are soon affected by alkalies, and also, but more slowly, by acids. Tops treated with paraffin are, however, open to the objection that the wax is liable to melt when exposed to heat. The use of asbestos mats is suggested to meet this difficulty. Wooden tops covered with 7 lb. lead are sometimes found. They are in use at Finsbury College and Bristol University College. Such tops are very satisfactory, but it is not necessary to go to the expense of such a provision for school work. It is probably not more apt to break glass apparatus than hardwood. A small bead along the edge of the benches is a useful addition, to prevent things rolling or slipping off.

Fume Closets.—Fume closets are provided in laboratories so that experiments involving the production of noxious gases can be carried out without vitiating the air in the laboratory. They consist usually of a small cupboard with glass front and sides measuring from 2 to 3 ft. in height, 2 ft. wide and 1 ft. 9 in. in depth. The size is of course open to considerable variation. They are placed usually against the wall of the room, so that the ventilation flue can be more easily managed, and in a position easy of access to the benches. The size of the fume closets should be limited to that of the largest apparatus that is likely to be used in them, since the object being to get rid of the gases formed as quickly as possible, the smaller space there is the better.

The Number Required.—It is usually found that one fume closet to every five students will meet the ordinary requirements of a school laboratory. Where small draught hoods * are supplied on the working



42. Fume Closet.



43. A Row of Four Fume Closets.

benches, one large closet, or at the most two, will be all that is required. The front of the closet has to be made so that it will run easily up and down; this is usually done by means of sashes and pulleys. The pulleys should be large and run easily. The annoyance caused by breakage of the lines and the liability of disarrangement has led to the adoption of a light sash running in a groove, with small spring attachments that hold the sash in any position in which it is put.

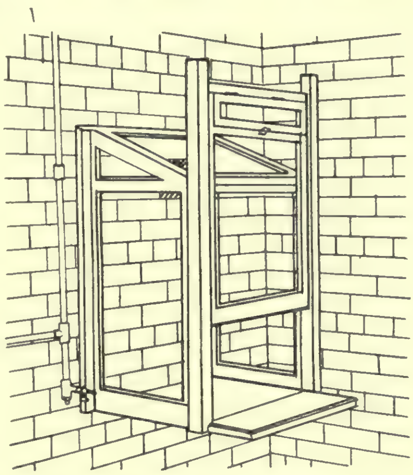
It is necessary of course to provide some means for the admission of air when the closets are in use. Leaving the front sash raised causes considerable disturbance to the flame of the gas used for heating inside. This difficulty is commonly met either by having some sort of subsidiary sash openings at the sides or small holes pierced in the bottom of the closet. In order to prevent the escape of noxious fumes, when

* For description of these see page 142.

the sash is raised, through the opening between the inner side of the glass and the upper edge of the closet, some sort of automatic closing arrangement is required. The use of a thick piece of felt on a lath, so arranged as to press against the glass as the sash moves up and down, will answer the purpose.

The construction of a fume closet is shown in Fig. 42, which illustrates one at present in use at the laboratories at the Central Foundation School, Cowper Street. In Fig. 43 is shown a range of four fume closets, as built in the laboratory at the Birmingham High School. A gas jet is placed in the flue to provide for the exhaust. An inexpensive fume closet made by the North of England School Furnishing Company is given in Fig. 44. This is placed against a wall of glazed bricks.

The chief difficulty to be met is the destructive effect of the combination of acid fumes, moisture, and heat, upon any material that is used for the top of the closet.



44. A Fume Closet.

Slate and glass are commonly used, but do not stand heat well, being liable to crack, while the condensation upon these materials, as well as upon stone, is an additional inconvenience. Wood coated with tar or pitch stands fairly well, but if much heat is used is apt to warp and crack. Mr Robins suggests that probably the best and cheapest roof would be one made of enamelled iron, cast in the size and shape required, and coated with some enamel that would resist the action of acids.* The bottom is formed usually of lead or slate, with a groove and small drain to carry off liquids.

A fume closet at the Imperial Institute, arranged by Professor Dunstan, has been covered with white glazed tiles, with very satisfactory results; the gain in light also being of considerable advantage. The extract flue should of course not be carried vertically out of the centre of the closet, as condensed liquids and dust are likely to fall from it, and considerably interfere with any experiment being carried on beneath. The usual plan is to place it high up at the back of the closet. Replacing the ordinary round or square hole by a long slit the width of

* Technical School and College Building, p. 122.

the closet has the advantage of reducing the corners where stagnant air can lurk.

The draught is commonly obtained by the use of a gas-jet in the chimney, or in large institutions by the use of a fan. The gas-jet is very unsatisfactory owing to the impossibility of preserving the iron from corrosion by the fumes. A small fan driven by electricity where the current is available, and which can be obtained for £2 or £3, is usually much more satisfactory. The furnace for heating is sometimes utilised for the purpose of producing the necessary draught. Special closets for sulphuretted hydrogen, &c., hardly lie within the question of school laboratories.

Small Fume Hoods.—In addition to the large fume closets, it is now common to find in laboratories small fume hoods placed on the working benches, one to each pair of students. These are usually formed of wood with a sloping movable glass top (see Fig. 41). They are all connected with an exhaust pipe, taken to a flue with a strong upcast draught, gained either by the utilisation of the heat of the furnace for warming the building, by an electric fan, or otherwise. These serve for the purpose of experiments involving the production of a certain amount of bad gas, but not a sufficient quantity to make the use of the big draught closet necessary. This plan has been adopted in many schools, and is found a great convenience. The gas-jets are in some cases so arranged that no heating can be done except under these hoods. The only objection I have heard to the use of these small draught closets is that their small size concentrates the fumes, and so is likely to cause rapid corrosion.

Lockers.—There is considerable difference of opinion on the question as to the desirability of supplying a locker for each student. It is perhaps hardly possible to do so in a large school where the number of pupils learning chemistry is very large. With an ordinary laboratory it is usually possible to get in about three times as many lockers as there are working places. It is usual to have a drawer with a cupboard underneath it. In the case of older pupils doing more advanced work it is a great convenience that some place should be provided where they can keep their own apparatus or safely put away an unfinished experiment. There is an ingenious arrangement at Felstead School by which much time and confusion is saved; there are under each working place three sets of drawers and cupboards; the cupboard shuts with a spring lock, and when shut also locks the drawer. The boys learning chemistry are in three sets. The cupboards are so

arranged that each set or class of boys has one cupboard in each set of three, so that in each case the owner of the cupboard has his place at the bench immediately above it, while the owners of the other two cupboards belong to another set working at a different time. By having different coloured labels for the names for each set of boys it is easy for the laboratory attendant to go round and open all the cupboards of the class that are coming in. If there is not sufficient space to allow a cupboard to each pupil who uses the laboratory, room may be found to supply a fair-sized drawer.

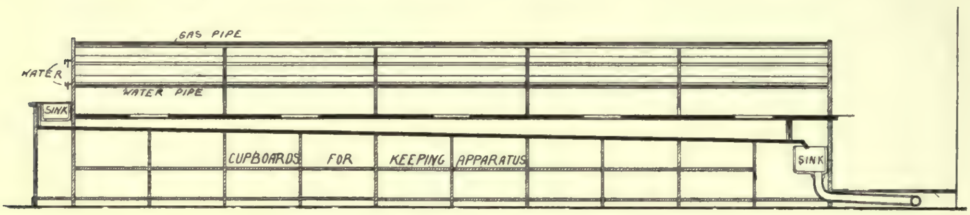
WASTE AND DRAINAGE.

Sinks.—The sinks are made square, usually with flat bottoms, in order that when required they can be used for pneumatic troughs, though this use is not very often feasible. They should be fixed level or rather below the surface of the bench in order that spilt liquids may be swept freely in without obstruction. This makes their removal in case of breakage somewhat difficult, but if made of thick glazed stoneware, this is an unlikely contingency. A movable and close-fitting top is sometimes useful, as it enables apparatus to be placed upon the top when necessary.

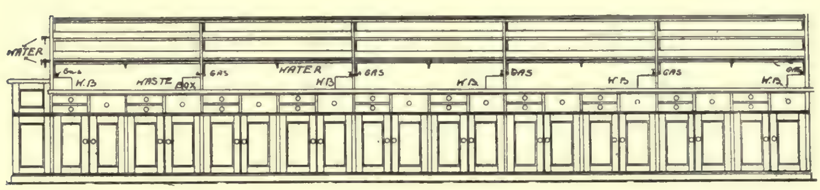
The important point in connection with the waste from the laboratory benches is to provide easy access to every part of it, so that the obstructions which are sure to occur can be readily got at and removed. This is sometimes done by merely running the waste along open gullies in the floor. There should always be an arrangement which will allow the waste to deposit most of the solid matter it carries with it. Professor Garnett * suggests that it should be arranged in the following way—that there should be a sufficient space left in the centre of the benches to allow of a man passing through. This space serves to carry the gas and water pipes, and the drainage trough. The latter may be made of 1 or $1\frac{1}{4}$ in. red deal boards, jointed so as to form a **V** trough about 6 in. deep. The trough is thoroughly caulked with a mixture of pitch and tar, put on hot, and this trough serves to collect the drainage from the sinks, and deliver it to a sludge box or small settling tank through an overflow on one side. The overflow from the sludge box is delivered into a similar trough laid in a chase in the floor, which conveys it to the downcomer outside the wall. In place of **V** troughs, semicircular troughs cut from the solid in red deal may be employed. These semi-

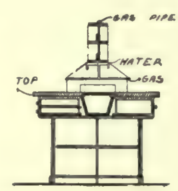
* The Design of Technical Schools. Paper read to the A.A. by Professor Garnett, 15th January 1892.

circular troughs are largely used in chemical works, and avoid the joint of the V trough. For the downcomer, best stoneware pipes, salt glazed, may be employed, but cast-iron paper coated with preservative compound will last a very long time, and some experiments will probably be made shortly upon the suitability of enamelled cast-iron pipes for this purpose. Rectangular troughs have no advantage over V troughs, and only offer a much larger surface for the acid liquids to act upon. The chases in the floor which may carry gas-pipes, water-pipes, pipes for distilled water, compressed air for the blow-pipe, and vacuum for filtration purposes, in addition to the drainage troughs, should admit of being opened throughout their whole length for the purpose of inspection.



SECTION OF LONG TABLE.





SIDE ELEVATION OF LONG TABLE. CROSS SECTION OF LONG TABLE.

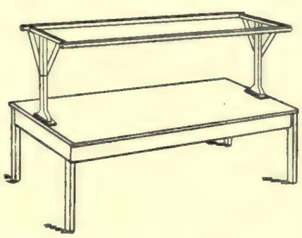
45. DETAIL OF WORKING BENCH FROM FIG. 35, SHOWING THE USE OF A WOODEN TROUGH IN PLACE OF SINKS.

The necessity of supplying a number of sinks with their plumbing, a costly item in laboratory fitting, can be obviated by the use of properly-treated wooden troughs or boxes. A method of doing this is shown in Fig. 45. The ordinary stoneware sinks are replaced by a long wooden trough which runs the full length of the benches, covered by short lengths of board easily removable, so that it can be opened and made to form a sink at any convenient spot. The trough is coated thickly with a preparation of tar, and laid to a rapid fall, discharging into a collecting sink, where any solid matter is deposited. At the end of the trough is a grating to catch any large solids. This illustration shows the arrangement as working at the Birmingham High School for Girls. A plan of the laboratory is shown, Fig. 35. This use of

tarred wood provides an effective and economical method by which the cost of fitting up a laboratory may be much reduced. It can be equally well adapted to form large sinks of the ordinary type. There should be a collecting vessel underneath where the solid matter that is washed through may be deposited. This is arranged so that it can be easily taken out for cleaning.

For arrangements of benches and fittings of a more advanced character, a large amount of information will be found in Mr Robins' book mentioned above.

Physical Laboratories.—The main desideratum in a physical laboratory is a large working table steady and free from vibration—a somewhat difficult matter to secure. Various methods are in use—stone brackets and stone or slate tables built into the walls, with and without stone brackets; sometimes, where possible, stone or brick pieces are brought up from the basement to about 3 ft. above the floor with a heavy stone or slate top. In these cases care has to be taken that the floor boards or joists should not be in actual contact with these piers, or the vibration caused by persons moving about the room would of course be communicated to the piers.



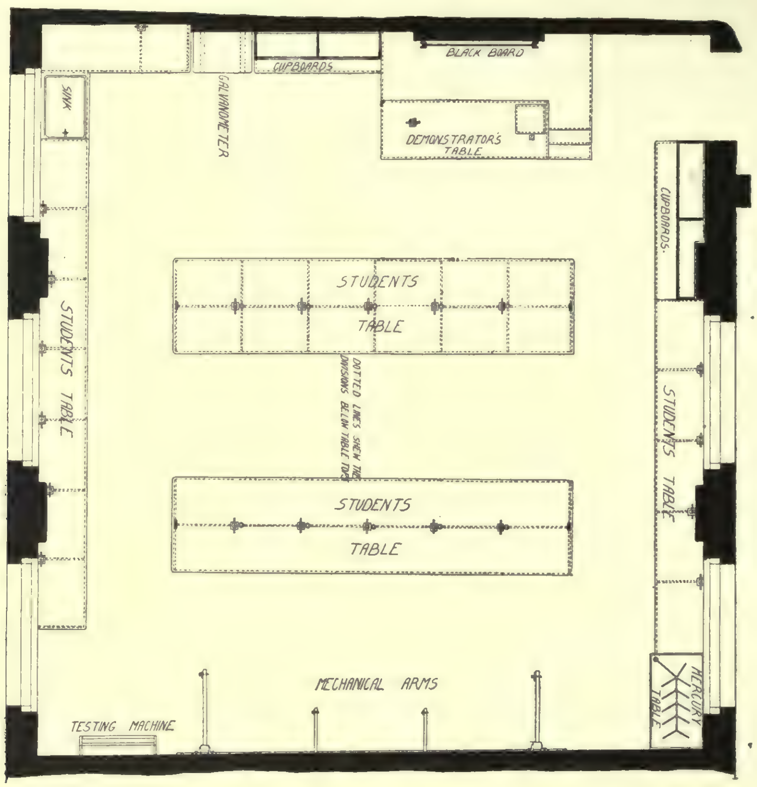
46. Table for Physical Work.

There is even more difficulty about settling as to the exact requirements of physical than in the case of chemical laboratories, as there is such a large variety in work done there. However, as long as the tables are steady and there is plenty of room, it will probably answer most purposes. It is usual to supply gas to each place on the working benches or tables, but not water or sinks; one or two large sinks with water-taps in convenient places being generally considered sufficient. Shutters arranged so that windows can be easily darkened quickly are desirable for optical work. There should be arranged above the benches (see Fig. 46) a high framework, with hooks, to which can be attached apparatus such as pulleys, &c., for mechanical experiments.

Long cupboards should be provided which can be constructed right down the centre of the working benches, while leaving room for cupboards on each side. This will enable apparatus that is too long for the ordinary cupboards to be stored.

Where the physical laboratory is not used for very advanced work, tables of the ordinary type, but made unusually heavy and solid, with teak tops, will answer most purposes. It should be remembered

that a teak top measuring some 6 by 3 ft. and $1\frac{1}{2}$ to 2 in. deep is of great weight, and unless precautions are taken to strengthen the framework, the latter is likely to give way when the tables are moved. These tables should have a groove near the edge in which mercury can be collected. In the physical laboratory at Felstead (see Fig. 36) tables of this sort are in use, and are not fixed; the gas being supplied by pendants from a main running along the roof. These pendants are



47. THE PHYSICAL LABORATORY, COWPER STREET FOUNDATION SCHOOL.

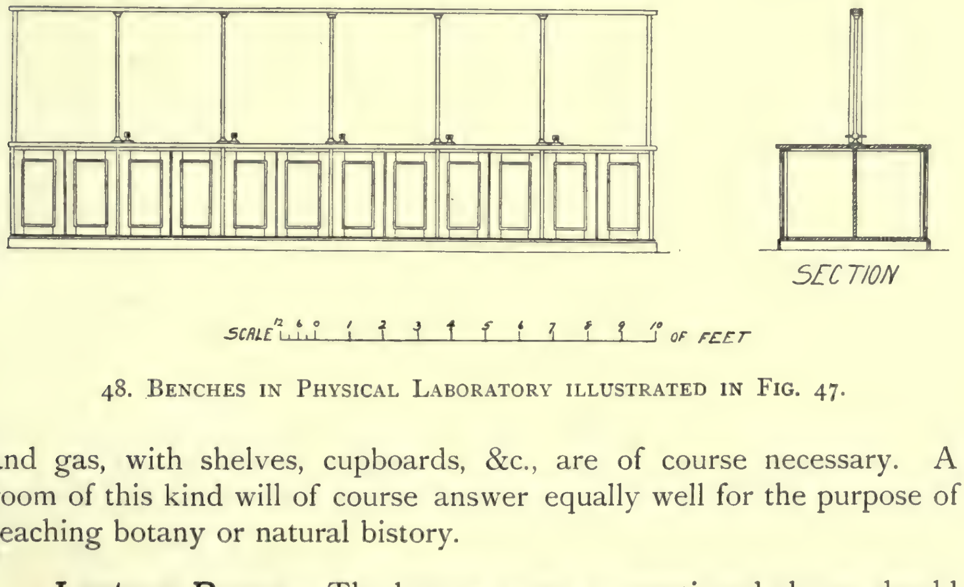
H. Chatfield Clarke, Architect.

jointed, and can be doubled up to a height of 7 ft. from the ground when the proximity of iron is undesirable.

Fig. 47 shows the physical laboratory of the Cowper Street School, the chemical room of which was illustrated above. The benches are here fixed, a gas-jet being supplied to each place, but not sinks; one large sink being considered sufficient for the room. Over each bench is a framework for the suspension of apparatus (see Fig. 48), while

at the end of the room are arranged mechanical arms for larger experiments involving the use of considerable weight. A mercury table is placed in one corner. A specially arranged shelf, secured against vibration by being built into the wall, is provided for the purpose of experiments involving the use of the galvanometer. A demonstration platform with table and blackboard completes the equipment.

Biological Room.—The room for the study of biology need not be of any great size, as the number of students taking this subject is not likely to be large. It should be well lit and well ventilated. Benches, steady enough not to be moved by the pressing of the hand, in the windows, either low or provided with high stools for the purpose of microscope work, are required. A large sink, and a supply of water



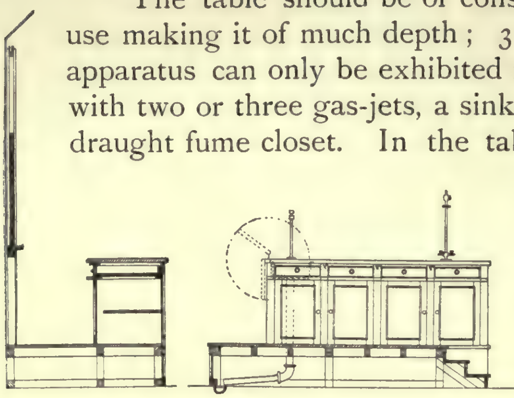
48. BENCHES IN PHYSICAL LABORATORY ILLUSTRATED IN FIG. 47.

and gas, with shelves, cupboards, &c., are of course necessary. A room of this kind will of course answer equally well for the purpose of teaching botany or natural bistory.

Lecture Room.—The lecture room, as mentioned above, should be readily accessible from both the physical and chemical laboratory. If it can only be placed in connection with one, it is probably better to put it near the physical laboratory, as the apparatus that will be required in the lecture room for physics teaching is often very heavy or very delicate. Again, if electrical experiments are being shown it is often necessary to keep the apparatus outside till the moment it is required, in order to ensure of its being of the necessary dryness, &c. In large institutions it is of course necessary that the lecturer's table should be absolutely free from vibration, and so this room is usually placed on the ground floor. But the elaborate arrangements necessary

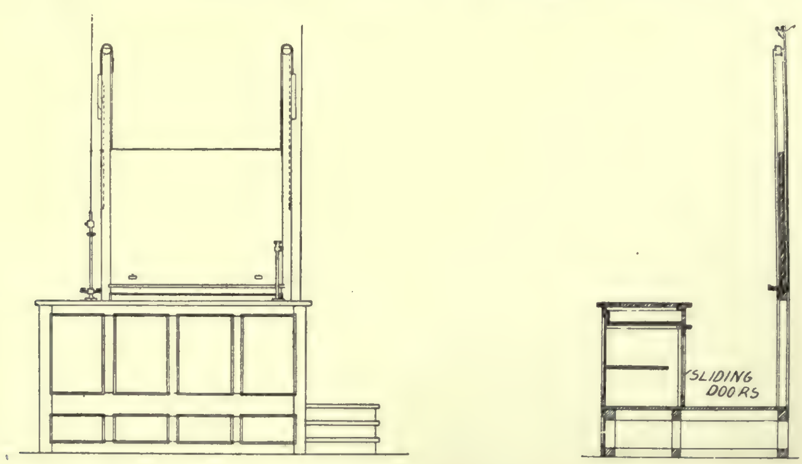
to ensure this and the other devices and contrivances found in such rooms are hardly necessary in an ordinary school lecture room.

The table should be of considerable length, but it is of little use making it of much depth ; 3 ft. will probably be sufficient, as apparatus can only be exhibited in one row. It should be fitted with two or three gas-jets, a sink with a movable top, and a down draught fume closet. In the table shown in Fig. 49 there is a large sink with a movable cover to turn over, shown by dotted lines ; the back of the table is fitted with cupboards, &c., and the position of the black-board is shown. Fig. 50 shows a simpler form of lecturer's table for physical lectures.



49. Demonstration Table (Inside Elevation and Section).

There should be some space left between the lecturer's table and the wall behind ; this is necessary both to allow plenty of room for the master and his assistant, and for certain experiments, such as for instance where a beam of light is thrown from a galvanometer on to a scale upon the wall. Eight feet is not perhaps too much. The light should of course be arranged with the view of lighting the demonstration table and the blackboard behind it. If the lecture room is on the top floor, a lantern in the roof will often provide a good light. The windows should be arranged with screens that can be easily drawn when it is required to darken the room.



50. Demonstration Table.

A piece of the wall behind the demonstration table should be prepared for the purpose of magic lantern exhibition. A square of 12 ft. is large enough for most purposes, while 16 ft. may be regarded as a maximum. An excellent surface can be obtained by finishing the wall with Parian cement, and giving it two coats of plain lime whiting. Across this the blackboard may be placed. In this case it must be movable, and may be fitted with the Kelvin principle of counterbalancing weights, so that it will run easily up and down. A platform or shelf for the lantern itself must be provided at the back of the room. If this is required to show any delicate experiments, it will be necessary to bring a brick pier up to carry it, which must be kept quite independent of the seats.

A few hooks fixed in the ceiling, or better still an opening into the room above, exactly over the demonstration table, for the purpose of suspending apparatus, is often of great convenience.

The seats have to be arranged in rising tiers in order that every one may have a free view of the lecture table. This should be arranged so that each pupil may see the whole table, even if the person in front is two or three inches taller. In cases where the room is small and the seats have to be brought close up to the demonstration table, the gallery will have to be inconveniently steep if every one is to see the table well, but by increasing the distance the steepness of the slope is rapidly reduced. The table should be not less than 5 ft. from the first row of seats. The rows of seats may rise from 6 to 12 in., increasing in height towards the back. It is usual to provide 20 in. for each place.

A small workshop in connection with the science rooms is a great advantage; this need not be more than about 8 or 10 ft. square. It should be fitted with a small bench, a vice, and tools for working in tin and zinc, soldiering materials, &c.

Studios.—The main requirements of a studio are a steady light, which should be ample and under easy control, and plenty of space. The steadiness of light is usually obtained by making the studio window face to the north. Probably the best aspect is rather to the east of north. Opinions differ as to the relative advantages of top light and side light, but whichever form be adopted it should be carefully arranged so that it comes from one direction, in order to avoid any danger of cross lighting. When the light is brought in by a vertical window on one side it is necessary to make it of a much larger area than in the case of a top light. The sill should be at least 6 ft. from the floor.

A long narrow room with a window running down one side often forms a convenient shape for a studio for school purposes, as it is easy then to cut it up by means of curtains or otherwise to suit divisions doing different work. The window should be fitted with blinds, which should be arranged to draw up from the bottom, or curtains, arranged so that it may be easy to adjust the light to suit the various purposes. The studio is usually placed upon the top floor in order to secure a good light.

51. The Englefield Easel.

Area Required.—This should be ample. At least twice as much floor space per head as is required for a class-room should be allowed. Drawing is now one of the regular school subjects, so that the studio should be at least capable of accommodating the largest form in the school at once. Any additional space that can be provided will add much to its convenience. Where no storage room is provided, a considerable provision must be made for shelves and cupboards, racks for drawing boards, &c.

52. A Studio for a Large Elementary Class.

A piece of wood 2 or 3 in. wide let in flush with the plaster and carried round the room about 2 ft. above the dado, as suggested for class-rooms, should be provided, upon which to pin up drawings. A useful form of easel for school work is shown in Fig. 51.

A method of fitting up a studio for a large class doing elementary work is shown in Fig. 52.* This provides a slightly different view of the model for every pupil in the class.

* From the catalogue of the North of England School Furnishing Company.

Chapter IX.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

Cloak-rooms—Question of one large Cloak-room or separate Rooms for each Class —Pilfering in Cloak-rooms—Suggestions of a Headmaster—The American System, Examples of—The Manchester High School—The Blackheath High School—Space required for Cloak-rooms, Lockers, Stands, and Racks—Measurements of Stands—Material for Floor—Kindergarten Cloak-room—**The Principal's Room**—Position of, in reference to Secretary, Porter, &c., to Entrances and to Hall—Accommodation for Inspectors and Examiners—**Dining-rooms**, Position in Basement or Top Floor —Sizes necessary for Tables—Distance apart, &c.—**The Kitchen** and its Position—Mid-morning Lunch in Girls' Schools—**Libraries** for Masters and for Pupils—Use of the Library in German Schools—**Sixth Form Rooms,** Arrangement of—Differences from an ordinary Class-room—**Museums**, their Position—Opinions on their Use—**Emergency Rooms** and Sick-rooms—Bath-rooms—Cleaning Rooms—**Music-rooms**, Size and Position—Methods of Sound Prevention—Practising and Teaching Rooms—Use of Class-rooms for Music Lessons—Play and Recreation Rooms, Size required for—**Kindergarten Schools** and their Arrangements—Desks, Tables, Chairs, &c.

CLOAK-ROOMS.

Cloak-room accommodation raises a number of debatable points, the most important of which is that of the relative advantage of having one large cloak-room with accommodation for the entire school, or whether it is better to have it in two or more separate places, or finally to have, as is commonly done in America, a separate cloak-room attached to each class-room.

The first plan is undoubtedly the pleasantest. All the wet clothes, &c., can be kept right out of the main part of the building; the place can be properly warmed and ventilated; a drying-room can probably be placed close by; and if the room is well planned, and stands well arranged, one mistress, for it is in Girls' Schools that the question of cloak-rooms is naturally of so much importance, can supervise the whole room. On the other hand, it is urged that when most of the school are dismissed together, there is a great deal of crowding and confusion;

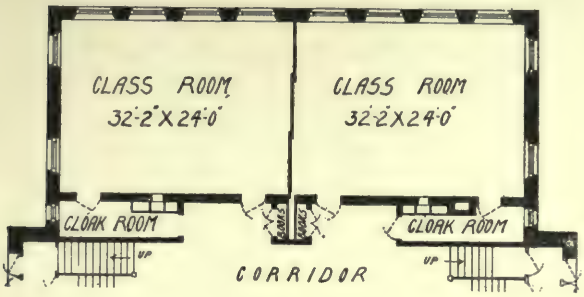
that it is not always possible to keep a proper watch upon it; and that in this way it offers too many chances for one of the most annoying offences of school life, that of petty larceny. This is an offence in which detection is difficult, and one which, from the mutual suspicion and distrust aroused, and the unpleasantness and evils arising from the attempts made to discover the offenders, causes great trouble to Head Masters and Mistresses of schools, so much so that they are generally willing to put up with a great deal of discomfort and unpleasantness, and the unsightly appearance generally attached to the arrangement of a cloak-room attached to each class-room, in order to make sure of an effectual supervision, which would render pilfering impossible. In large Day Schools where the pupils are drawn from very different classes of society, however good the tone of the school, there will be from time to time children who will be only too quick to avail themselves of any opportunities of the sort that may occur. A Headmaster,* writing on Secondary School planning, suggests that—

"The remedy is to abolish the central cloak-room altogether, and instead of it, to attach a separate cloak-room, and put it in charge of the master who teaches in that room. It should be about 6 ft. wide, and should run the whole length of the class-room. It may be 9 ft. high, or it may be carried up the full height of the class-room. It should be separated from the class-room by a wooden screen, pierced with a continuous window, and the master should be so placed that he can command every part of it. It should be thoroughly well lighted by an external window, and be heated by hot-water pipes, so that wet coats may be dried. There should be two doors, both leading back into the class-room and not into a corridor or the hall."

This arrangement is carrying the system often adopted in America a step or two further (see below, Fig. 54), and while perhaps possible in an Elementary School, would hardly be tolerated in the Secondary Schools of this country. Even if the assistant teachers did not object, there would be a considerable number of inconveniences attached. The unsightly appearance in the class-room; the smell of clothes, especially in wet weather, which would inevitably come into the class-room; the loss of space, which, as it is to be 6 ft. wide with an external window, must be taken off the aspect chosen for the class-rooms; and finally, the almost hopeless confusion that would, under certain circumstances, ensue at the end of lesson time, especially if the school were at all full. In case of a class which spent the last

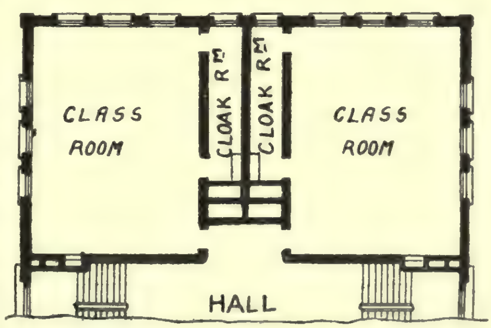
* *The Builder*, 4th January 1890.

hour in the studio or chemical laboratories, either the form master would have to be back in the empty class-room to see his class take their coats and hats, for the only entrances were to be from the class-room, or else it might happen that some division was being taken in the room, in which case the disturbance would be considerable. In a German School, where the classes are not reclassified or divided, it would no doubt be easy to manage some such plan, or in America, where this system is commonly found, where each pupil has his regular seat in one of the large schoolrooms, but it would surely be difficult in a school organised on the lines of our Secondary Schools. The proposal, however, shows to what lengths the heads of schools are willing to go to obtain really effectual cloak-room supervision.



53. SHOWING CLOAK-ROOMS AS PASSAGES TO CLASS-ROOMS.

The American system of providing cloak-rooms in the form of passage-rooms to the class-rooms has not, as far as I am aware, been yet tried in this country. In that country the usual plan (see Fig. 53) is to have an entrance both to the cloak-room and the class-room, so that access can be gained to either one without necessarily going through the other. But in many cases the only access, as mentioned above, to the cloak-room is through the class-room itself (see Fig. 54). Sometimes, as in Fig. 324, there is a sort of cupboard each side of the door of the hall itself, or rather the wide corridor is cut up into small cloak-rooms (see Fig. 154), practically turning the hall into a cloak-room; but whatever plan is followed, there is a separate cloak-room to each class.

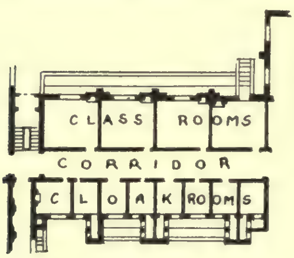


54. SHOWING CLOAK-ROOMS WITH THE ONLY ACCESS THROUGH THE CLASS-ROOMS. From an American School.

Mr Briggs, in "Modern American School Buildings," strongly advocates the use of partitioned hat and cloak rooms placed in the main hall of the building, suggesting further that the upper parts might

be wire netted in order to make supervision more easy. It will often be noticed, on looking at plans of American Schools, that the greater part of the main hall is taken up with the cloak-room arrangements. There would be strong objection to any similar plan being adopted in this country, where every effort is made to keep the floor space of the assembly rooms or halls as free as possible.

At the Manchester High School for Girls there is an arrangement adopted after careful inspection of American plans, and after visits to a number of their schools (see Fig. 55), by which there is a double cloak-room arranged to every class-room, placed on the opposite side of a wide (18 ft.) corridor, each cloak-room also containing a water-closet disconnected from the building by a lobby. The accommodation allowed for cloak-rooms is on a lavish scale, and few schools would be now able to afford the expense of such a scheme. The doors leading into these rooms are cut off at a height of 3 ft. 6 in. to allow of supervision. The Headmistress, Miss Burstall, speaks very highly of the comfort and success of this arrangement. But the expense involved has probably prohibited its general adoption, and also perhaps the rather unsightly appearance in looking down the corridor; for though this school has been built some twenty years, it has not, to my knowledge, been tried in any other Girls' Schools, and certainly has not been adopted to any considerable extent.



55.

At the Blackheath High School for Girls, the plan has been tried of a long cloak-room running along a corridor in the basement, divided into a number of small rooms corresponding to classes. This obviates some of the disadvantages in the way of crowding.

However, the plan most usually adopted now is to have one or two large rooms fitted up as cloak-rooms, as near the pupils' entrance as can be conveniently arranged, and provided that sufficient outside window space can be given, there seems little objection to their being placed in the basement, while there are many advantages arising from such a position, they occupy space that cannot well be used for any other purpose, and are kept well away from all the parts of the building used for school purposes.

As regards the space required, there is very much less given or required as a rule in Boys' Schools than in Girls'. In a great many Boys' Schools no regular cloak-room is to be found. At the Mercers' School in Holborn, rebuilt in 1894, boys are expected to use the

lockers, of which every boy has one, arranged in the corridors. These are of sufficient height to allow of pegs upon which coats can be hung, and umbrellas put inside, while providing a shelf above for books, &c. They are raised 3 in. from the floor. The bottom of the locker is perforated to allow wet umbrellas to drain into a channel arranged underneath, while a hot-water pipe runs through all the lockers. The same plan is in use at St Paul's, West Kensington. At Bedford Grammar School there are pegs for hats and caps in the small passages which lie between the class-rooms and the hall (see Fig. 72). Of course this is partly a Boarding School, and when the boys come from boarding-houses close to the main block of the school building, they have probably only a cap, and not always that to dispose of. This can usually find a refuge in the boy's pocket.

In the case of Girls' Schools much more elaborate arrangements are necessary. The cloak-room must not only provide room for the disposal of hats, coats, &c., but pigeon holes or shelves must be provided for every girl attending the school, for the purpose of holding a pair of boots or shoes. Facilities must also be provided for the purpose of changing their boots, and it must be so arranged they can do so in considerable numbers without confusion.

Dimensions for Cloak-rooms.—In fitting up a room for a cloak-room it is usual to have the fittings placed against the wall space as far as that is available, and to get the additional accommodation required by placing stands across the room. These would be arranged with a seat each side, separated by a screen with the necessary pegs on each side. The hooks or pegs should be at least 12 in. apart. The width of a stand with seats and pegs each side may be calculated at 18 in. These should not stand closer together than from 6 to 7 ft. to avoid disorder in moving about. At the ends of the stands which come opposite the wall there should be a clear space of from 4 ft. to 4 ft. 6 in. Taking these dimensions it will be found that it is necessary to allow between 4 and 5 sq. ft. of cloak-room per pupil, the exact amount depending on the amount of wall space that can be devoted to fittings after allowing for windows, doors, &c. Of course where there is plenty of room it is a great advantage to allow a larger space. This will make supervision easier, and prove a great boon when a large number require to use the room at once.

At the Birmingham High School, where the cloak-rooms and lavatories are particularly spacious and well arranged, there is one large cloak-room measuring 68 by 30 ft., the number of the school

being 300 (see Fig. 123). The additional cloak-room accommodation required becomes often a serious problem in the case of additions to a school, a contingency which should not be lost sight of in the original scheme. In planning a cloak-room, great care should be taken to have no awkward corners, *i.e.*, it should be possible to see the whole room from one point. It should of course be well lit, and have means of thoroughly efficient ventilation. Hot-water pipes carried round the room and through the centre of each stand are usually provided to keep the clothes dry and well aired, though it is not well to rely upon this for drying things really wet, for which purpose there should be a regular drying-room arranged in connection with the heating apparatus. The boxes or pigeon-holes for boots should be raised from the floor, so that the whole floor can be easily washed. Arrangements of wire racks on which the boots are to be balanced do not work as a rule satisfactorily, the shoes and boots usually finding a resting-place on the floor.

In order that washing should be easy and quick, the floor should be of some non-absorbent materials of which tiles are undoubtedly the best, both from the point of view of appearance and health. Unfortunately they are rather expensive.

Cement, although making in many ways a good floor, is not suitable for schools, as it is easily kicked or rubbed off, making an unpleasant and deleterious dust. Wood blocks, though not drying so rapidly, are preferable. Asphalte seems inclined to wear rough and unevenly.

In speaking of cloak-rooms with reference to American Schools, Mr Shaw strongly advocates a special cloak-room to each class-room, and suggests that in fitting up a cloak-room the best plan is to have a shelf 15 in. wide supported on strong brackets right round the room 5 ft. from the floor, on the under side of which, about 15 in. apart, and about the middle of the shelf, double coat hooks are screwed, thus ensuring a complete circulation of air about the clothing. They are blocked out from the wall to allow circulation of air, and curved in at the bottom, so that the room may be easily swept.* The stands shown in Fig. 275, provide for a thorough circulation of air, while preventing the clothes from contact.

In schools where there is a Kindergarten there should be a separate cloak-room for that department in close connection with it, and also

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* Cloak-rooms for Elementary Schools are further considered when dealing with the plans of such schools.

separate lavatory and necessary W.C.'s attached. When planning the Kindergarten cloak-room, it should be remembered that it is usual to send a nurse or maid to fetch the children, so that some convenient place may be arranged in which they can wait instead of a draughty corridor.

Lavatories and sanitary conveniences are treated together in the chapter dealing with sanitation.

PRINCIPAL'S ROOM.

The position of the Head Master or Mistress's room is a matter requiring some consideration. It is usually found close to the main entrance, which is generally an excellent position for the purpose of visitors to the Headmaster. It should also be as near as can conveniently be managed to the platform end of the hall; firstly, so that the Head Master can gain his place on the platform with the least possible waste of time and trouble, and further, because in cases of functions of any kind, it is usual for persons who are to occupy positions on the platform to collect in the Head Master's or Mistress's room. At the Mercers' School in Holborn the Headmaster has a door leading directly on to the platform from his room, and mentioned it as a particularly convenient arrangement (see Fig. 117). There should be in close connection with this room a Secretary's room and a small waiting-room, and also a lavatory and closet. In larger schools there will be also a Clerk's office connected with the Secretary's room. The Headmaster's room and Secretary's room should be in close connection, there being continual need for communication, either leading from one to the other, or, as is sometimes the case, having communication by a hatch or window. In small schools where space is an object, the Secretary's room has to serve for a waiting-room. The room for the Head Master or Mistress should not be too small, a mistake not infrequently made. It often happens that the Head Master or Mistress may wish to take a small class or division there. Where a Committee-room is provided, it is often conveniently put next the Secretary's room, or it may serve for the Secretary's room, being only required for Committee or Board meetings at considerable intervals. There should of course be lavatories attached. In the plan of the City of London School (Fig. 108) a convenient arrangement is shown. It will be noticed that there is a small turret staircase leading from the Committee-room directly to the platform in the great hall. It is difficult to find any common plan for the arrangement of these rooms; but usually, close to the main entrance of

the school, are found accommodation for the Headmaster, Secretary, Secretary's office, and the porter, and the more easy the communication the better. There is an additional consideration in the case of Girls' Schools which should not be lost sight of, and that is the accommodation for Examiners and Inspectors when visiting the school. In very large establishments there will no doubt be found separate accommodation provided, but in schools where in planning every square foot has to be zealously looked after, it would not be possible to make provision for such an occasional need. Of course the waiting-room can well serve for this purpose, but as the Examiners probably spend the day in the school, some provision should be made for their comfort. In case no space can be spared to provide a lavatory for the waiting-room, the most economical plan is probably to arrange that the Headmistress's room and the waiting-room should both open into the same lavatory, in which case, by locking one door or the other, it can be attached to either room as required.

The telephone-board, with an attachment to every part in the building, placed in the Headmaster's room, though occasionally useful, is probably rather more a theoretical than a practical advantage, as far as the class-rooms are concerned; but a speaking-tube to the kitchen or schoolkeeper and the Secretary's room, if the latter is not close by, is undoubtedly useful. When there is a complete system of tubes, the Head Master or Mistress is usually obliged, in self-defence, and to avoid continual disturbance, to have a rule that all calling up should originate at their end.

The Principal's room should, if possible, command the entrances to the school.

DINING-ROOMS.

A dining-room has as a rule to be provided in Day Schools. The number of pupils staying to dinner in the middle of the day will of course vary considerably according to the locality and other reasons. In some schools very elaborate dining arrangements have to be made, the greater part of the school staying to dinner. There are two ways of arranging the dining-rooms and kitchens. One, and perhaps the commonest, is to have the dining-room and kitchen in the basement; the other, to devote the top floor of the building to this purpose. There are many advantages in the latter plan, the chief of which is the absence of any chance of the smell getting into the school part of the building, since effectual ventilation is easy. And when expenditure in the building is of importance, it is possible to

provide a light and cheerful dining-room in the roof, where the slope of the ceiling would prevent its use for any other purpose.

The Newcastle High School for Girls, recently erected by the Girls' Public Day School Company, has an arrangement of this sort with satisfactory results (see Fig. 119).

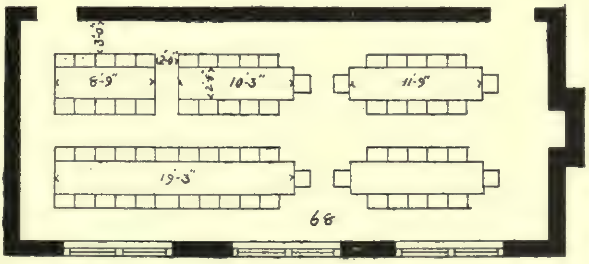
At St Paul's School, West Kensington, where over 200 boys dine every day, there are most complete and excellent arrangements (see Fig. 112), also placed on the top floor.

In order to calculate the amount of space that is required per head for the dining-room, the important point is the space taken by the table, and the distance between the tables necessary to allow of sufficient space for waiting. The amount of cubic space is of less importance, provided that the room can be thoroughly aired, as it is occupied for so short a time.

The Size of Tables, &c.—The following short table gives the dimensions which may be taken to give sufficient room :—

	Ft.	In.
Width of table - - - - - -	2	8
Width of one place - - - - -	1	9
Depth of one place - - - - -	1	4
Distance between backs of seats of two adjacent tables	2	6
Distance from wall to back of seat - - -	3	0
Distance between the ends of two adjacent tables -	2	0

In Fig. 56 is shown a plan illustrating different ways of arranging the tables and seats. Where a seat has been placed at the end of the table, a space of 1 ft. 6 in. has been left. In the case of a table wider than 2 ft. 8 in. this could be dispensed with and the side seats brought up to the end. This should be considered the minimum allowance of space to ensure a comfortable room.



56. Various Arrangements for Dining-room Tables.

The kitchen and dining-room are on the top floor in the Birmingham High School for Girls, and as the demonstration room is close by, they can thus be made use of in the cookery instruction

if required (see Fig. 129). A Headmaster, writing in *The Builder*,* describes the dining-hall at the Ecole Monge in Paris. The boys ate at little marble tables. As soon as they had finished, a relay of servants carried off plates and dishes; the windows were thrown wide open; a mighty hydrant was opened, and a deluge was sent flying over tables, floor, and walls; and in a moment, crusts, crumbs, smells, and foul air disappeared in one gush. The windows were closed, heat turned on, and soon the hall was ready for another batch of diners.

It is hardly necessary to lay stress on the point that the kitchen should be in close connection with the dining-room, with a hatch making perhaps the best arrangement. Whatever scheme be adopted for the kitchen and offices, it is of the greatest importance that they should be thoroughly cut off from the rest of the school building.

Mid-morning Lunch.—In Girls' Schools it is usual for the girls to have some slight refreshment in the middle of the morning, taking as a rule the form of a glass of milk and a bun. A hatch with a fair amount of space round will serve the purpose well, and obviate any tendency to crushing and confusion. The large kitchens required in Boarding Schools are more fully dealt with when considering the subject of those sort of schools.

THE LIBRARY.

It is becoming more and more recognised that a library is a very necessary adjunct to a school, not so much in its older form which consisted of a collection of books, often very valuable, put in a room, to which no one, except perhaps one or two of the masters, ever went; but a library to be used continually by the upper parts of the school, containing all the books of reference that are likely to be wanted, and the books so selected that it can be thrown open to the school, or rather to such part of it as may be considered advisable; for there is little use in the younger part of the school having access to a room intended for quiet study, and containing books for reference, not for light reading. This want should be otherwise and fully provided for. The chief use of the school library is to enable those in the higher forms of the school to learn to use books for themselves, without being told exactly where to look for anything. This of course applies with equal force to Girls' Schools, where it is becoming more and more the custom to allow the sixth form to use the library as a room for working

* *The Builder*, 4th January 1890.

in when doing individual and private work. There should be also a teachers' library. In German Schools it is almost invariable to find the two libraries, one for the school, the other for the teachers. Of course when two rooms cannot be provided, there may be certain cases reserved in the general library; but the great point is that the library should be regarded as a room to be used. Where it is not possible to provide a separate room for the library it may be possible to fit up a room otherwise used with the necessary shelves.

The sixth form room at a pinch will serve for the library, as these are the pupils who will chiefly use it. The Headmistress's room sometimes serves for the purpose, but this is open to the objection that it is apt to interfere with the pupils having the free use of it. As regards the other sort of library, that of fiction and books for recreation and pleasure, while it is perhaps of little less importance that there should be a good supply of the best books of this sort, and that the boys and girls of every age should be induced to read them, the position of their accommodation in the school premises is not of much importance, wherever bookcases or shelves can be conveniently put up. The dining-room will often provide a good deal of wall space.

Sixth Form Room.—It is usual in Girls' Schools as well as in Boys' Schools to have what is known as a sixth form room. In order to keep up the idea of the difference in status acquired by those who have reached the dignity of the sixth form, and as it were to mark them off a little from the rest of the school, and perhaps to add to their feeling of responsibility, and to a certain extent to their authority, this room is fitted up differently to a class-room. Work is probably done at a large table with chairs instead of the usual desks; it is more carefully looked after, and begins to take on more the air of a sitting-room than a class-room, with jealously regarded privileges. However badly warmed, lit, or ventilated, it is a delicate matter to touch this room, or suggest changing to another, however much better the new one may be in every way; more especially if the school is an old one, there are associations and memories attached to the old room with which it is an invidious task to interfere. In building a new school the sixth form room should if possible be arranged to be a pleasant and comfortable room, and need not necessarily be on the pattern of the other class-rooms.

Museum.—A special room to be used as a museum is found as a rule only in large schools, and is of course a most valuable adjunct to the school; but it is probably only in the great Boarding Schools where

museums of any size are found. But it may often be worth while when planning a school, if a museum cannot be provided, yet to allow space in some corner or corridor where cases for specimens or cabinets can be conveniently placed. There is some diversity of opinion as to the value of museums in schools. Some Headmasters, who think that their real value lies in the collecting, even go so far as to recommend that all the contents should be thrown away at the end of the year. This of course can only refer to collections of flowers, stones, &c., which are made by the school in its immediate neighbourhood. But unless there is some master or mistress who will take an energetic and continual interest in it, a museum is apt to degenerate into a rather forlorn and miserable place, and the room given to it could, except in large buildings, be probably better utilised for other purposes. There is an interesting account, illustrated with plans, of a school museum, in the second volume of the Special Reports issued by the Board of Education.

Emergency Rooms.—There should be in every Day School at least one emergency room, or a room in which any boy or girl who is unwell can lie down in quiet, or where any pupil who comes to school and being unwell is suspected of having some contagious disease, such as measles and scarlatina, &c., can be isolated. It should be placed as far as possible out of the way, both for isolation, and in order that it may be quiet and undisturbed. A lavatory attached is of course an advantage.

Bath-rooms.—A bath-room is sometimes provided. For example, in the Birmingham High School there is one, and the Headmistress, Miss Creak, mentioned it as being very useful on certain occasions. I gathered it was used chiefly for remedial purposes, in such cases as girls being overcome by the heat, and sometimes also when they had driven long distances to school in very cold weather. On the whole it seemed that it was not very often that it was wanted, but that on occasion it had been of great service.

Service-rooms.—Cleaning-rooms for brushes, &c., with hot and cold water laid on, should be always placed on each floor in some convenient position. The lack of this precaution is the cause of a good deal of the trouble that sometimes arises with school keepers and cleaners of school buildings.

Music-rooms.—Music-rooms have to be placed as far as possible where the sound will cause least disturbance. The usual plan in Girls'

Schools—they are not always supplied in Day Schools for Boys—is to have a line of them placed together (see Fig. 88), allowing as a rule two to every 100 girls. The size should not be less than 8 by 10 ft., nor is there much to be gained by their being larger, provided there is sufficient room for the piano, pupil, and teacher. They should of course be warmed. For teaching singing a room twice the size at least is necessary. The usual plan to prevent the interference of the sound between the adjoining rooms is to make the walls hollow and packed with some material adapted to stop the passage of sound as far as possible, asbestos, &c., and to provide double doors. It is worth remembering that neither the joists, and more especially the floor boards, should continue from one room to another. I have more than once seen a row of two or more music-rooms where the most elaborate precautions to stop the sound had been taken with the walls and doors, but which were entirely nullified by the floor boards, which were continuous. It is not unusual in Girls' Schools, where the expenses are to be cut down, to provide no music-rooms, on the ground that the pianos can be put in the class-rooms, since these rooms are not as a rule used in the afternoon in such schools. This plan will be found to cause a great deal of inconvenience, and to be objected to strongly by both the Headmistress and by the music teacher, owing to the constant interruptions caused by pupils coming in for books and things left behind, &c., or their having to be turned out because the room is required for some purpose. In Boarding Schools * a rather larger number of music-rooms are required for the purpose of practising.

Playroom.—Though this can hardly be considered an absolute necessity in a school, it is of the greatest advantage to have some such room where it is lawful to make a noise during the recess between lessons in wet weather. A room of this sort is almost invariably found in America, even in the Elementary Schools. It is not uncommon to find in Secondary Schools in this country a covered playground in the basement, of the same size and immediately under the hall. Of course where there is a gymnasium in the school it will perfectly well do for this purpose. At the Birmingham High School (see Fig. 129) there is a playroom provided on the top floor. This is the more necessary as the building is not only a very high one, but there is no playground, owing to the restricted nature of the site. A space of 5 or 6 sq. ft. per pupil should be provided if possible.

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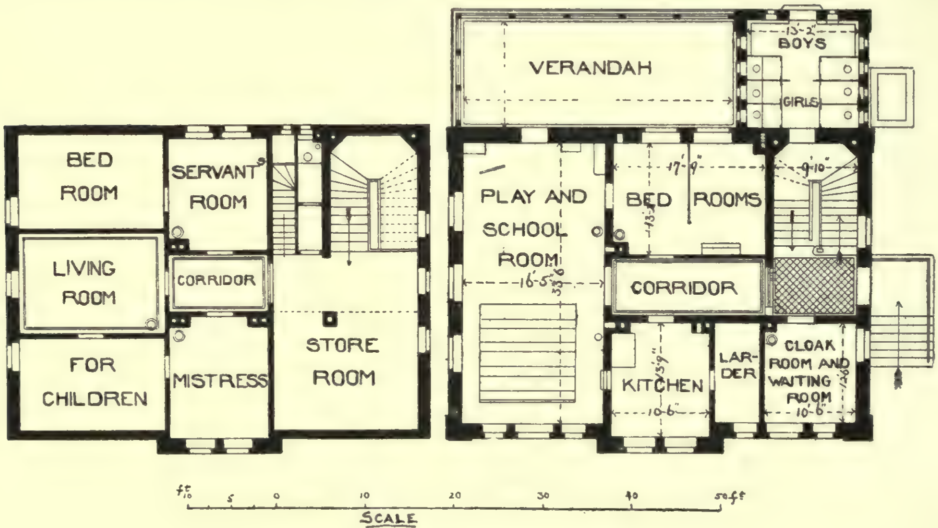
* See below, page 220.

Kindergarten Rooms.—Where the Kindergarten is merely an adjunct to a school, as is so often the case in Girls' Schools, there is little else required for the purpose than a large, well-lighted, cheerful room, with its separate cloak-room and offices. In providing the lavatory accommodation, it should be remembered that there are usually boys as well as girls to be provided for. The room itself should be of ample size, and face south or south-east in order to ensure plenty of sun in the mornings. The sills to the windows should also be kept low. This room is not as a rule used in the afternoon, except when there are student-teachers attached to the Kindergarten for the purpose of training. The ground floor should always be the position for this room in order



57. A Kindergarten School.

Reinold Faber, Architect.

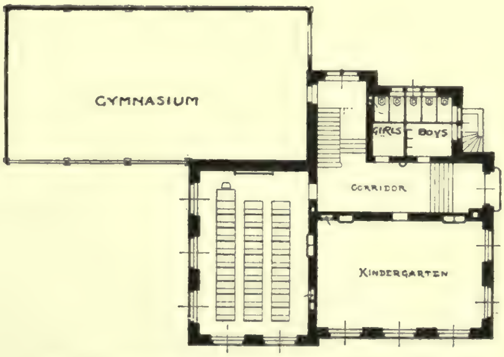
to avoid stairs, and it should be placed next the class-room, which is devoted to the transition form, or first form, if the former be taken in the Kindergarten room. This class-room may very conveniently be made rather large and divisible by a movable partition, as the transition form is classified with first one and then the other. Where the numbers in the Kindergarten are considerable, or where the Kindergarten is a school by itself, it is necessary to have a certain number of class-rooms. These need not be large, as the classes are not likely to consist of more than 10 or 12, but there must be either a hall or a room large enough to allow plenty of space for the marching and games which play so large a part in a Kindergarten training.

In Germany it is usual to supply living rooms for the Kindergarten

teacher in the building. Hinträger * gives the following list of rooms for a Kindergarten :—(1) Employment room ; (2) playroom ; (3) cloak-room ; (4) office ; (5) living rooms ; (6) sanitary conveniences ; (7) play-ground and gardens.

58. KINDERGARTEN SCHOOL, ZÜRICH.
A. Geiser, Architect.

The gardens are considered an important part of the school. They should be shaded by trees, and provide not less than 3 sq. metres (30 sq. ft.) per head, and the whole in no case less than 1,500 sq. ft.† According to one writer, the garden should be of large size, and contain arbours for working in, aviaries, a labyrinth, a maze, heaps of sand, little gardens for the children, ponds and fountains.‡



59. KINDERGARTEN SCHOOL, ZÜRICH.

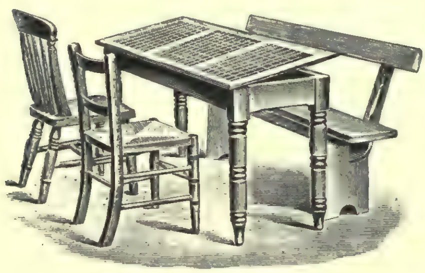
Fig. 57 shows the plan of a small Kindergarten School. This is intended to take in children as boarders. The verandah makes an excellent place for marching and playing in warm weather.

* Bau und Einrichtung von Pflege- und Erziehungsanstalten für die Jugend des Vorschulpflichtigen Alters, Hinträger.

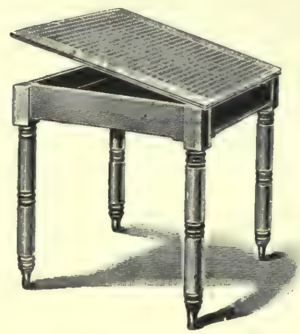
† Schulhygiene, Baginsky. ‡ Mutter- und Kindergartenbuch, Georgens.

Figs. 58 and 59 show the exterior view and ground plan of a Kindergarten School at Zürich.

The furniture of a Kindergarten room should be light and easily movable. For the older of the children desks of the ordinary type are made, but usually with flat tops marked in squares. The smaller children usually sit on small chairs at low tables, also marked in squares (see Fig. 60). Those with rounded backs are found the most satisfactory and most comfortable for the children. The teacher is supplied



60. Tables and Chairs in a Kindergarten.



61. Teacher's Table.

with a table marked similarly with small squares, and arranged with a top that can be raised (see Fig. 61) in order to make the surface visible to the class in front.

There is so much apparatus used in Kindergarten teaching, that plenty of cupboard room must be supplied, as well as shelves for the pots of flowers, aquariums, &c., that have to find a place. It is as well to provide wooden rails round the room on which drawings can be pinned up.*

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* See page 99.

Chapter X.

SECONDARY DAY SCHOOLS.

PLANS AND DESCRIPTIONS OF SCHOOLS.

Questions as to what constitute a Good Plan—Test of a well-planned School—Plans from the point of view of the Headmaster—Remarks of a Headmaster on School Planning—Girls' Schools and Boys' Schools—Types of Plans—The Central Hall System, Advantages and Disadvantages summed up—Opinions of a Headmaster and a Headmistress—Modifications of the Central Hall System—Examples of Schools—Colet House School—The Bedford Grammar School—Streatham Hill High School—The Sheffield High School—Aske's School for Girls, Hatcham, and at Acton—Coborn School for Girls—The Hulme Grammar School—Hymer's College, Hull—The Wimbledon High School—Stamford Hill High School—The City of London School—St Paul's School, West Kensington—The Mercers' Company School for Boys, Barnard's Inn—The High School for Girls, Birmingham—The High School for Girls, Manchester—The Judd Commercial School—A Realschule—The XII. Realschule, Berlin—Die Augustinerschule, Hesse—Gymnasium at Aachen—Secondary School, Zürich—The Brighton High School, U.S.A.—The Groton School.

The different rooms and various component parts that go to make up a school having been considered in detail in regard to their numbers, requirements, &c., it is now proposed to consider the arrangement of the buildings, and the various methods adopted in combining them to form a school ; but before proceeding to describe and illustrate the various types of school buildings, it will be as well to consider shortly what are the essential points that go to make up a good plan. Matters directly affecting the health of the scholars, such as questions of light, air, &c., are not here referred to. A school may be admirably lighted and fitted with every means that science or experience can suggest for its perfect heating and ventilation, and yet be badly planned. The point now referred to is that of the adaptation of the plan to the organisation of the school, and how far it assists to make the working of it efficient, easy, and economical ; how much the wear and tear is reduced for the Head Master or Mistress ; how much time is saved or wasted, in classes changing their rooms, for the Principal

in going his rounds; to what extent or with how little trouble can he know or find out what is going on in any particular place, or supervise the school during general movements; how many extra masters or mistresses are required on duty during recreation, or in the cloak-rooms during the assembling or dismissal of the school; whether elaborate sets of staircase or corridor rules are necessary to avoid disturbance or crushing, fruitful opportunities for which are provided by ill-designed corners, awkwardly situated doors, or narrow and dark places. The ideal plan arranges matters in such a way that all parts are so well lit and so easily supervised that there is no excuse for disorder, and no need for rules.

The cost of maintenance too will be materially increased or decreased according to the compactness and suitability of the plan or the reverse, but the chief importance of careful arrangement in this connection is rather to help the Head Master or Mistress in providing for the effectual discipline of the school. If the school is small, or if the Headmaster spends all his time at work in his own class-room teaching, or coaching a few brilliant boys in the top form, regardless of what is going on in the rest of the school, it is not of much use to take careful precautions to provide for easy supervision, or facilities for inspection, &c. This state of things, however, is becoming exceptional, and according to the custom prevailing now, it is usual for the Head Master or Mistress to do little or no regular teaching themselves, but to devote all their time to directing and supervising the work of the whole school; though perhaps taking every form some time or other to make sure that the work is going on properly. In the Continental Schools it is and has for a long time been quite exceptional to find the Headmaster teaching at all. It is significant of this that his title is not Headmaster but "Director." Not only has the Head Master or Mistress to keep an eye on and be responsible for the general discipline of the school during out-of-school hours, but it is very necessary that there should be some means whereby information can be easily obtained as to how matters are going on during school hours in the different class-rooms, either that an eye may be kept upon a new and untried assistant, or to see generally what is being done. This should be possible without causing disturbance to the class by entering the room. A common practice is to have the upper panels of the doors of clear glass, and while this is still strongly objected to in many schools, it is now frequently found, and undoubtedly has many advantages. But even without this, in the cases of

schools planned with a central hall, a Headmaster standing in the hall can as a rule locate any undue disturbance. These remarks on discipline and supervision hardly apply to what are known as the old Public Schools, where as a rule the class-rooms and boarding-houses are widely scattered about, and in different buildings, the school often being an aggregate of buildings built at different times as required. The school discipline itself too is to a large extent in the hands of the boys themselves.

The following remarks by a Headmaster of a Secondary Day School describe some of the difficulties to be contended with :—

"So long, indeed, as the boys are shut up in their respective class-rooms, the assistant masters are mainly responsible for discipline. But when the school is assembled together, *e.g.*, at prayers, or when all the boys are entering the building or leaving it, then the Headmaster is mainly responsible. Also when the classes are redistributed at the change of lessons, when boys are passing about for various reasons, it is the Headmaster with his porter or discipline master who is responsible. If you wish to make his task of supervision difficult, then build all the class-rooms in a line as at Reading School, so that the boys may have far to go in changing classes; and you may connect the class-rooms with a long echoing corridor, convenient for a stampede, for hustling, for running races. Narrow corridors especially facilitate hustling. Also sharp turns in a corridor will bring classes into sudden collision and riot at change of lessons. Nor will it be possible to detect the ringleaders if the corridor is dark. Moreover, a good deal of quiet bullying may be done in a dark corridor. While the Headmaster is in one corridor the riot can be started in another. Also if the Headmaster's private room is properly sequestered, the boys can be noisy with safety." *

As the chief object of supervision is to guard against disorder or bullying, it is of great importance that every corner of the playground and out-buildings should be easily visible from the Headmaster's room or the assistant masters' common room. The entrances and exits should be under observation. This can well be done by the porter if his room be well placed.

The differences between Girls' and Boys' Schools are small, and what there are, are more in matters of detail than in general arrangement, and as far as the general organisation of the school

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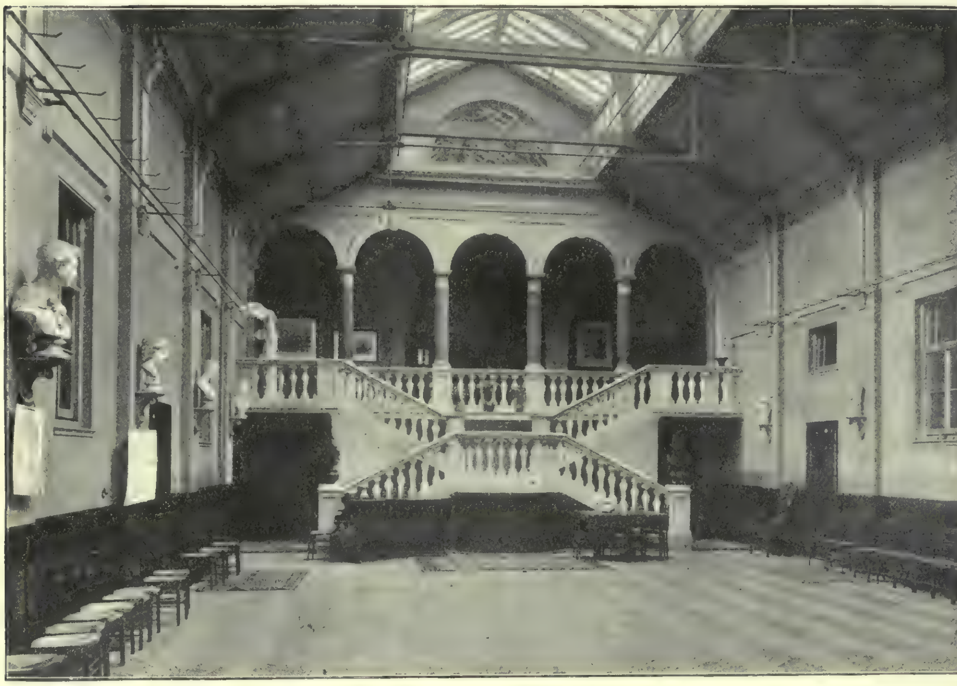
* A Paper on the Planning of Secondary Day Schools, by a Headmaster. *The Builder*, 4th January 1890.

is concerned, Girls' Schools are approximating more and more to that of Boys' Schools. In the large Public Day School the same subjects are taught on the same methods. Classification, distribution of classes, &c., and naturally the questions of lighting, warming, and ventilation, are the same for both, so that the two are here treated together, reference being made to any features that are peculiar to either.

Types of Plan.—There are, roughly speaking, two types of plan in large Secondary Day Schools. (1.) Those with a central



62. THE ASSEMBLY HALL, BLACKHEATH HIGH SCHOOL.

The Girls' Public Day School Company. *E. R. Robson, Architect.*

hall into which the class-rooms open directly. (2.) Those with class-rooms opening off a corridor, with the hall at one end of this corridor, or in some other convenient place, but separate from the class-rooms.

The former method, *i.e.*, the central hall system, is rapidly gaining favour as the best method of school planning.

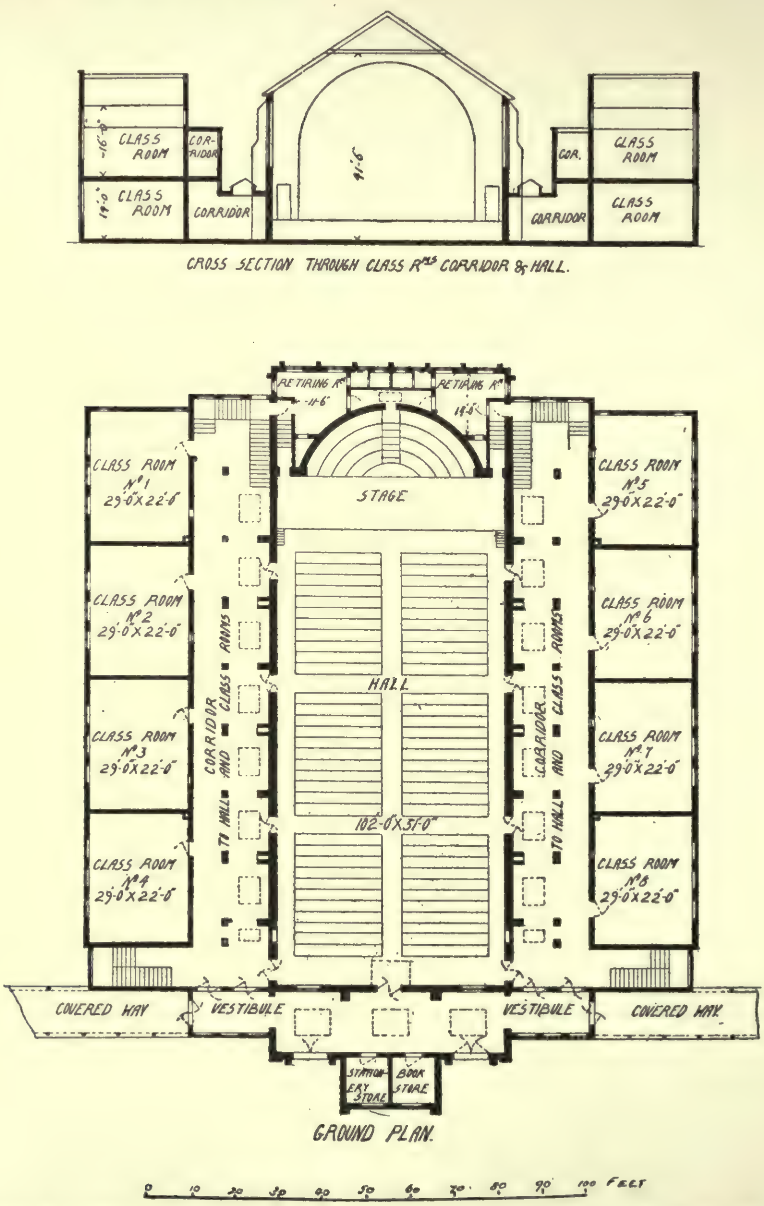
The advantages of the arrangement may be briefly summed up. The central hall provides the greatest possible economy of space by dispensing with corridors and passages, which in the other type

of plan have to be supplied in addition to the necessary space for the assembly room.

The main use of the hall being for the purpose of rapidly gathering the whole school together for prayers at the opening of school, &c., and then dismissing them to their respective class-rooms, it is essential that it should be easy of access. By arranging that all the class-rooms should open directly into the hall, this access is provided with the minimum loss of room. Supervision during movements of the school is reduced to its simplest form. The Head-master from his position on the platform can command the door of nearly every class-room. There can be almost any number of rooms so arranged. For instance, at Bedford Grammar School (Fig. 70) there are nearly thirty class-rooms opening off the hall, arranged on three floors by means of galleries. During school hours the Head-master is always right in the middle of everything, and if, as is usually the case, the upper parts of the class-room doors are glazed, he is able by merely walking round to command the whole work of the school. In fact, when the central hall can be kept principally if not entirely for the purpose of assembling the whole school when required, and of acting as a passage room, it seems difficult to see how this plan can be much improved upon. But it often happens that the hall has to serve a number of purposes—(1) Prayers in the morning; (2) for the collecting of the whole school for an address by the Headmaster, or for some social function, such as prize-giving, &c.; (3) during wet weather in schools where no covered play room or ground is provided it has to serve as a sort of recreation room during intervals; (4) where there is no gymnasium, the apparatus for gymnastics has often to be fixed in it, drilling under instruction, dumb bell exercises, &c., are there carried on; (5) for examinations, for special classes, or small divisions doing particular work, or part of a split-up form that can find no class-room vacant.

When the hall has to serve these different and almost contradictory purposes the question becomes more complicated, and the advantages of the plan more open to question. For instance, if an examination be going on in the hall the changing of classes is obviously disturbing when the latter acts as a passage-room, and a drilling class can hardly be carried on in the hall with sufficient absence of noise to avoid disturbing the adjacent class-rooms, indeed should the latter be glazed, a drilling or gymnastic class offers a strong counter-attraction to the work inside. On the whole, however, though there are drawbacks under such circumstances, the plan

has so many strong points in its favour, that heads of schools are almost unanimous in its favour when once they have tried it. For instance, a Headmaster writes :—

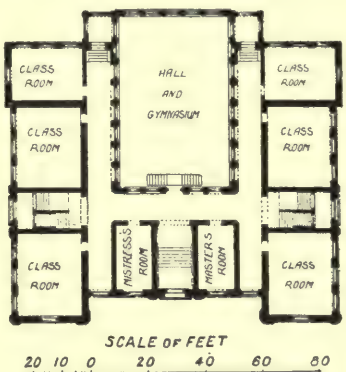


63, 64.—PLAN SHOWING METHOD OF SEPARATING CLASS-ROOMS FROM A CENTRAL HALL.
Basil Champneys, Architect.

"I can conceive of no greater happiness for a disciplinarian than to be able from his own room to see every boy who enters

or leaves a class-room. That is what the central hall comes to. There should be a continuous window, about 5 ft. from the ground, running along the side of the class-room which is next to the hall, so that the Headmaster as he goes round can see the state of discipline in each room without entering the room and disturbing the class at its work. Not that he wants to play the spy on his staff, but that he may easily see what are the classes where his assistance and presence is required by a weak disciplinarian or by some master newly appointed in need of help."*

An interesting testimony in favour of the central hall is given by Mr Robins in a letter to him from Miss Buss in reference to the new buildings for the North London Collegiate School: "During the time that we have had the use of the hall we have found it exceedingly pleasant. The opening of the class-rooms directly out of the hall is certainly a great advantage. The supervision is much more easy, as is the control of pupils while assembling and dismissing. The light and ventilation are excellent, far better and more complete than they would have been if you had given us a passage." †



65.
A German Central Hall.

Various devices have been resorted to in order to preserve the advantages of the central hall while obviating the disturbance caused by its use as a passage-room. For example, at Bedford Grammar School, by means of partitions, proposed, I believe, by the present Headmaster when the plans were under consideration, there are passages so arranged that while every class has direct access into the hall, there is an alternative route provided by which it is still possible to empty all the class-rooms without making use of the hall (see Fig. 72). Sometimes a corridor is taken round the hall between it and the class-rooms, in order to prevent disturbance by noise (see Fig. 64), taken from a competition plan by Mr Basil Champneys. This plan has many advantages, though of course it means a considerable waste of space, and though preserving the quickness of access, makes the supervision less complete. In Fig. 65 is shown an arrangement of a German School where a somewhat similar plan has been adopted.

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* The Planning of Secondary Day Schools, by a Headmaster. *The Builder*, 4th January 1890.

† Technical School and College Building, p. 206, E. C. Robins.

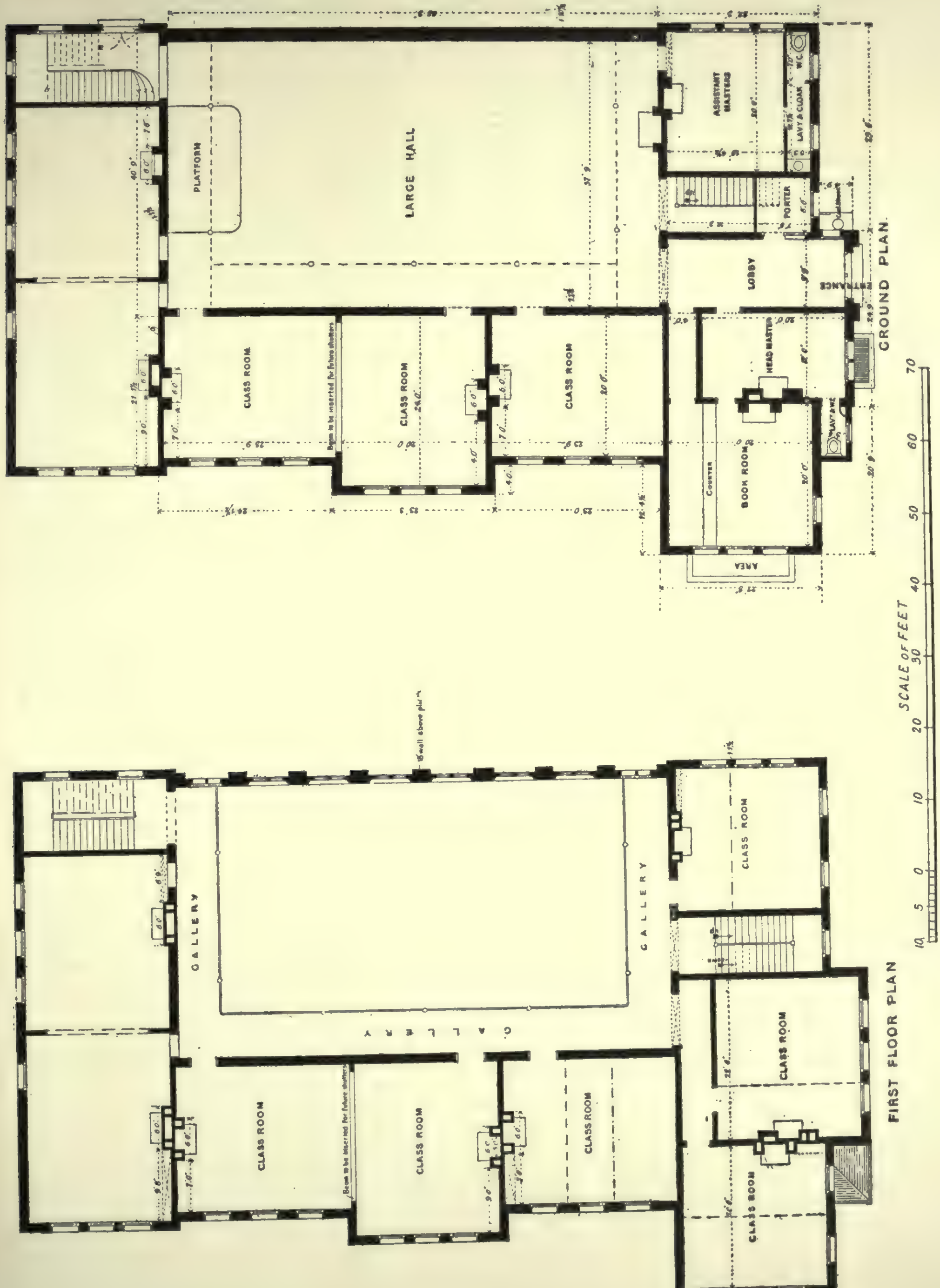
Various modifications of this scheme have been tried. For instance, at the Sheffield High School for Girls of the Girls' Public Day School Company the hall is arranged with a corridor along its inner side (see Fig. 86). In this way it is possible to have class-rooms on three sides of the hall without their actually opening into it. This particular plan has proved very satisfactory in use. A passage down the side of the hall formed by an arcade open to the hall, as for example at Hymer's College, Hull (see Fig. 103), or the Mercers' School, Holborn (Fig. 116), is often found convenient, as it gives the extra floor space to the hall, while leaving the main part of it unaffected by persons passing through.

There are of course many different ways of arranging the class-rooms with the hall. They may be placed all round, on three sides, or on two sides, as may happen to work in most conveniently with the arrangement of the building and the aspect of the site. The arrangement that seems most popular and widely used at the present time is that in which the hall or assembly room is placed on the north side of the building, and lit from that direction, the class-rooms, &c., being placed on the other three sides.

The examples which are given below will, it is hoped, show most of the different types usually found.

EXAMPLES OF SECONDARY DAY SCHOOLS.

Colet House School.—This school was opened in 1890 as a Preparatory Department to St Paul's School, West Kensington, close to which it stands. The building is an excellent example of the central hall system in its simplest form, consisting of nothing but the hall and its class-rooms, with the addition of a Headmaster's room and office, and an assistant masters' room. The building, which is intended to take 400 scholars, has a hall measuring 69 by 38 ft., off which open the class-rooms, there being galleries on the first and second floor for the purpose of access to the rooms above. A staircase at each end of the building enables the whole school to assemble in the hall and return to their rooms with the least possible loss of time or chance of disorder. It is reckoned that in case of alarm the 400 pupils, if seated at work in the class-rooms, could be all out in the playground in half a minute. This plan, although apparently so simple and straightforward, is the result of great care and experience, and is essentially what might be called a Headmaster's plan. There is not

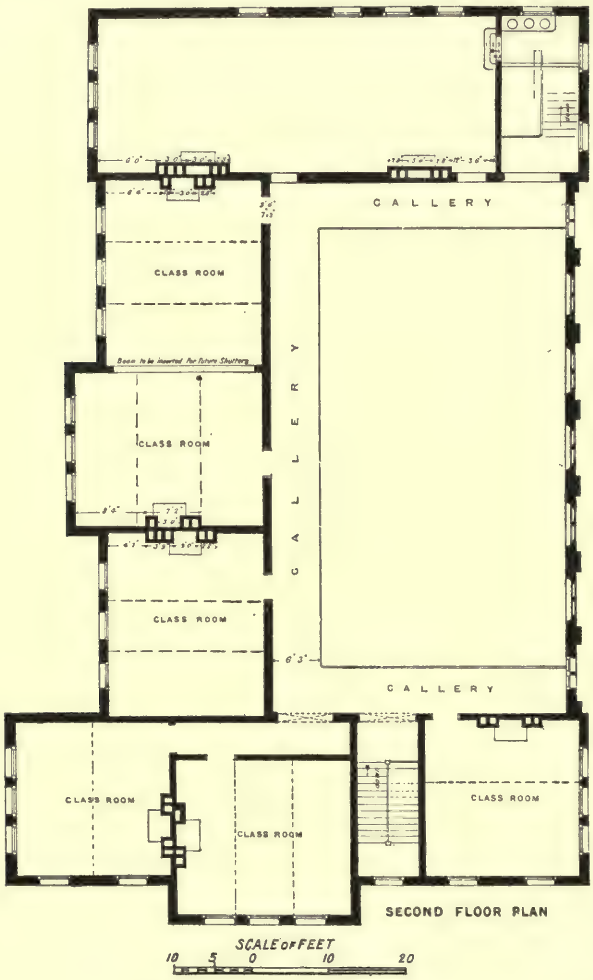


66, 67. Colet House School, West Kensington.

W. H. Spaull, Architect.

a corridor or passage in the building, and the Headmaster when in the central hall has command of the door to every room in the building except his own.

The school is heated by open fires, supplemented in the hall by hot-water apparatus. A Boyle outlet ventilator is fixed in each class-room. The offices stand away from the building in the playground. It will be noticed that there is no provision for cloak-room accommodation, or of hand basins for the boys. A certain number who live in the boarding-house* in connection with the school, and situated close by, do not of course require anything of the kind; but as these do not number more than 60, it would seem as though some accommodation should be provided for the larger proportion of the school.



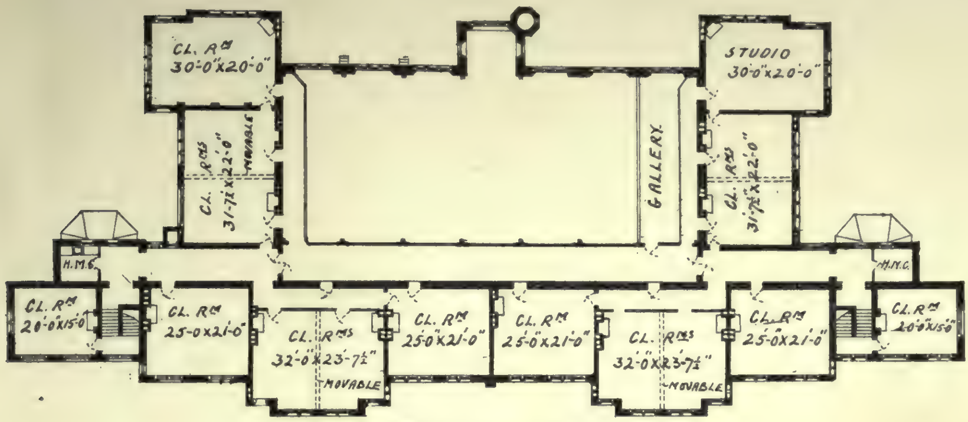
68. Colet House School.

The Bedford Grammar School.—This building is arranged on a somewhat similar plan to the foregoing example, but on a much larger scale. It will be seen on referring to the plans (Fig. 72) that the building consists of thirty class-rooms, every one of which has direct access into the hall, round which they are arranged. The class-rooms are of two sizes, the larger ones capable of accommodating 40 pupils, the smaller about 30, allowing 16 sq. ft. per pupil.

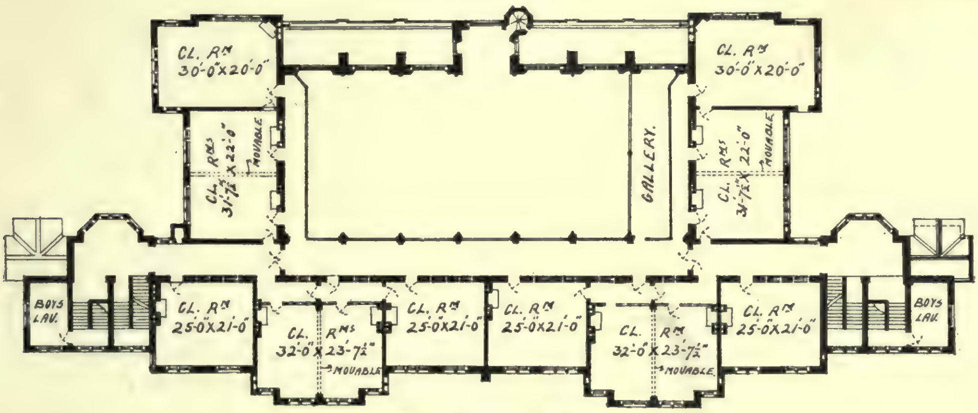
* Described and illustrated *post*, see page 253.

69. THE BEDFORD GRAMMAR SCHOOL.

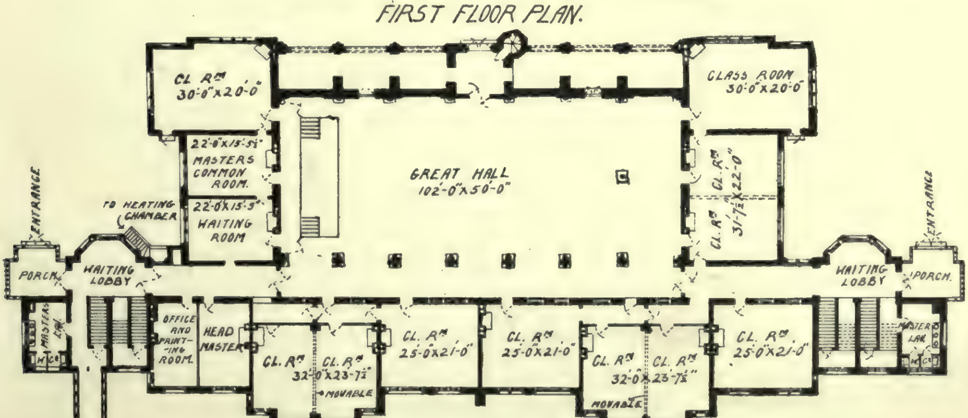
From a photograph by J. Thomson, Bedford. *E. C. Robins, Architect.*



SECOND FLOOR PLAN



FIRST FLOOR PLAN.



GROUND FLOOR PLAN

70-72. THE BEDFORD GRAMMAR SCHOOL.

The Harpur Trust. *E. C. Robins, Architect.*

In addition to the studio, there are sixteen of the larger class-rooms for 40, and thirteen of the smaller for 20, the actual seating accommodation being 1,030; but of course it would be quite impossible to work the school with anything like this number.* There are in the school at the present time about 800 boys, which is probably quite as many as could be conveniently managed in the building. It will be seen on reference to the plan that though all the class-rooms have a direct access into the hall, it is at the same time possible for the entire school to get out if the doors of the hall were locked and without passing through other class-rooms, except in the case of the rooms at the north-west and north-east corners of the building. This gives great power of quickly emptying the building in case of necessity.

The three floors are as far as possible arranged to correspond with the three departments of the school, the older boys being on the bottom and the Junior Department on the top floor. The three tiers of class-rooms correspond exactly, having the same numbers on each floor, while the particular floor is denoted by a letter. Thus any boy can at once tell where his class-room is or find any particular one without hesitation. The large galleries on each floor are used when the school assembles in the hall, as far as their capacity will allow, to accommodate the boys from the floor to which they belong. This saves a great deal of unnecessary movement, and as the entire school assembles twice a day in the great hall for prayers, every gain in speed of movement and economy of time becomes of great importance. The staircases are well placed at each end of the building, and doubled as far as the first floor, discharging, as has been mentioned already,† into a corridor 8 ft. wide, increased opposite the stairs by a large bay window, which provides a convenient backwater or waiting place when two lots of boys meet. The boys' entrance is at the east end of the building, the door of which, however, faces north. It was found in cold weather with a north-east or north wind, that very strong and unpleasant draughts were caused while the doors were open, in the hall and up the stairs. In order to obviate this, Dr Philpotts, by doing away with a small extra lavatory for the use of the assistant masters——there being besides sufficient accommodation for them near their common room—was able to make an extra entrance on the south side, so that in certain winds the doors on the north are closed, and those

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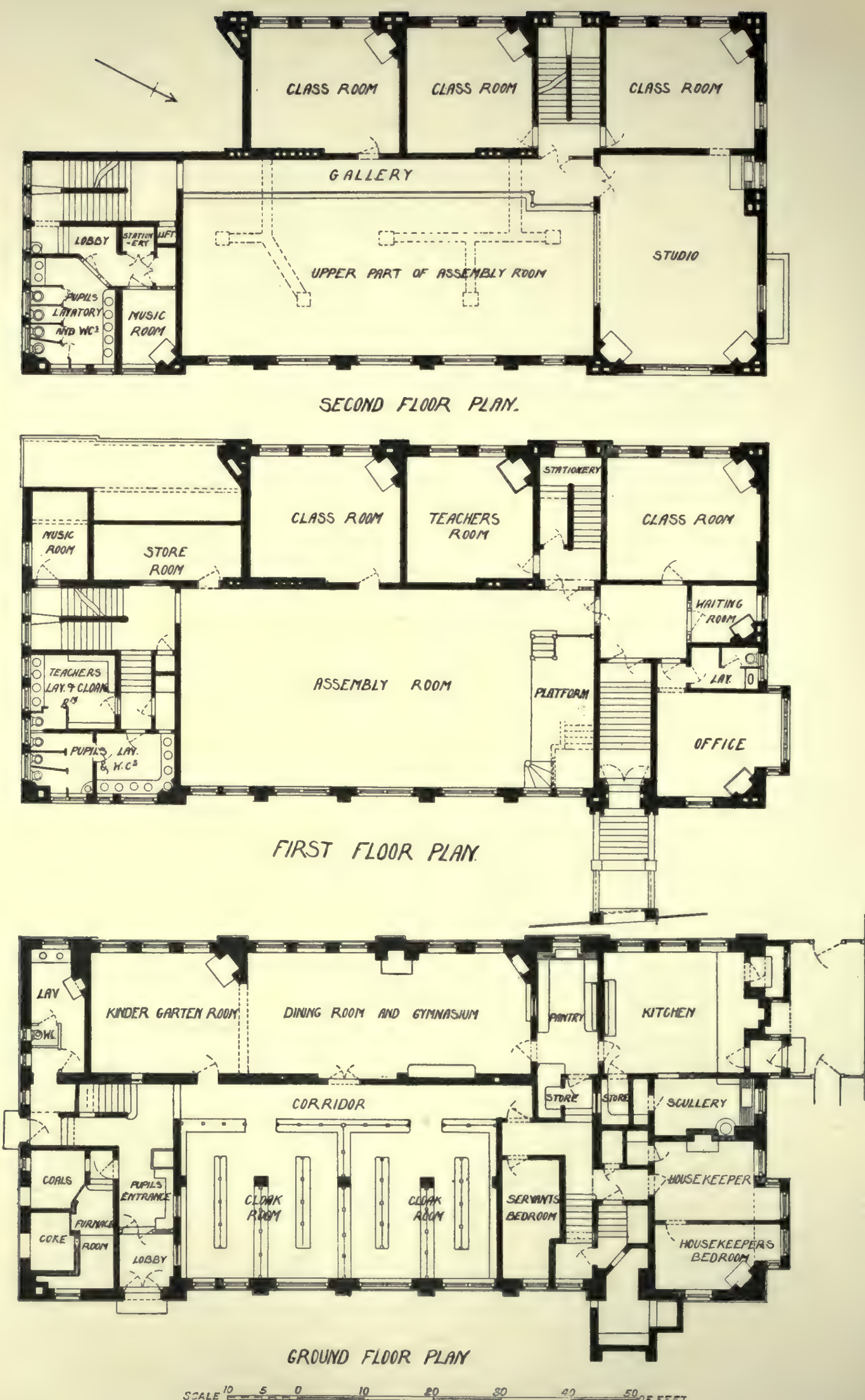
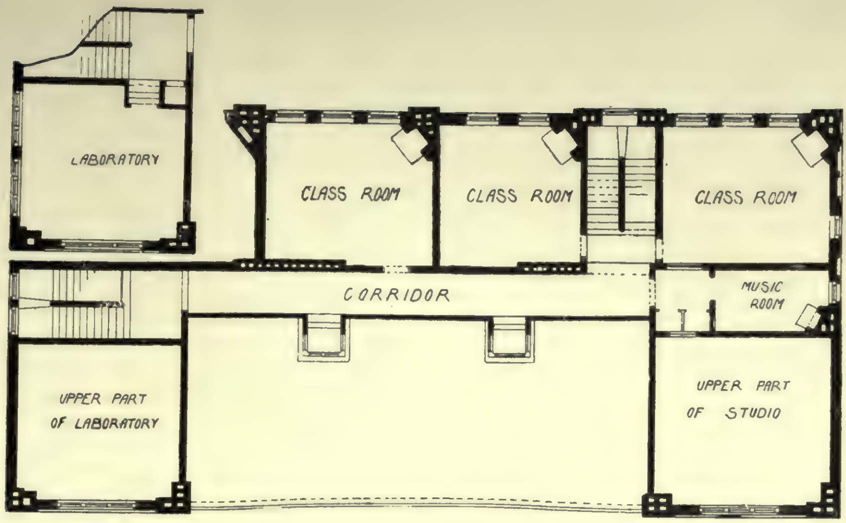
* See page 59. † See page 72.



73-77. HIGH SCHOOL FO

The Girls' Public Day School Company.



THIRD FLOOR PLAN.

INTERIOR OF HALL.

IRLS, STREATHAM HILL.

J. Osborne Smith, Architect.

Between pp. 178 *and* 179.

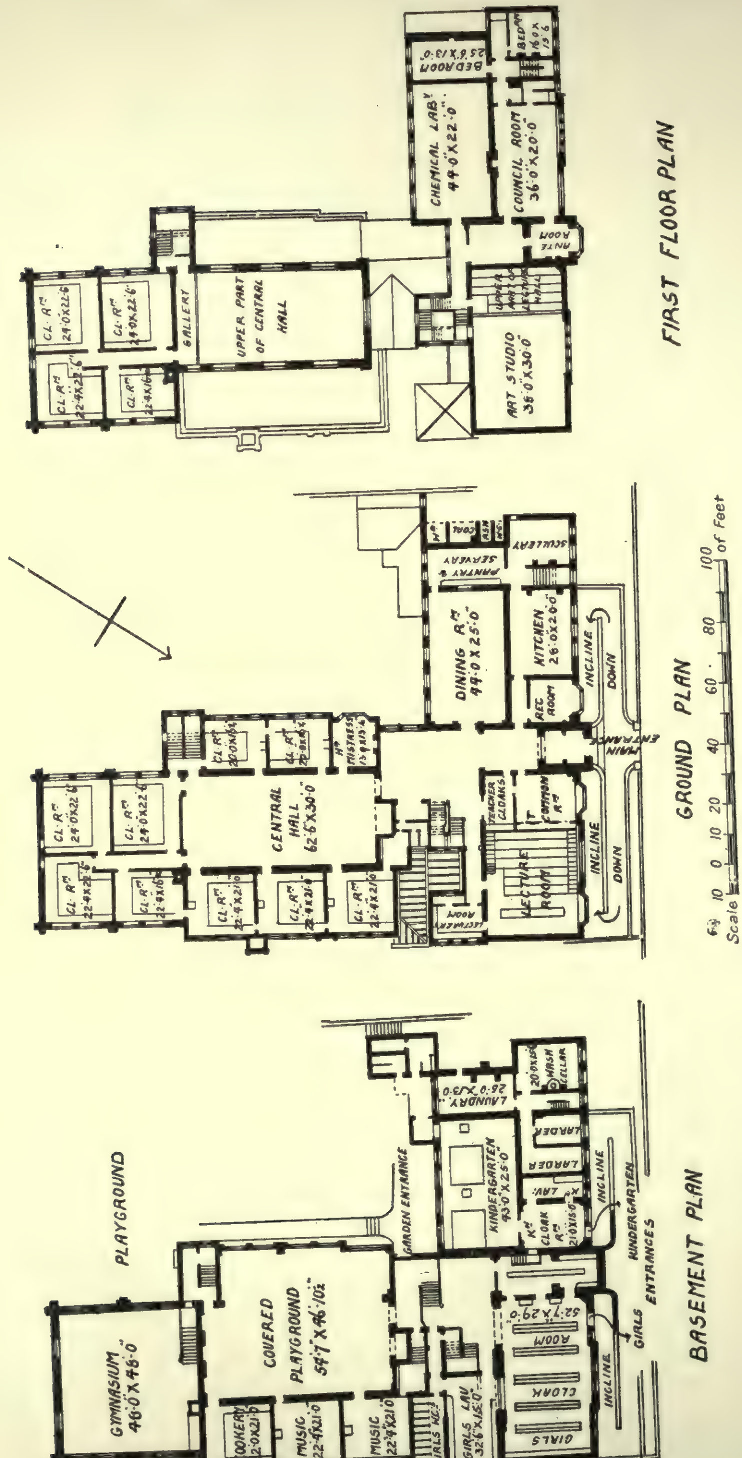
on the south used instead.* This alternative arrangement might well be borne in mind when planning a new building.

Every class-room has a ventilating grate in addition to the warming apparatus—Boyd's Hygiastic stoves being in use in the class-rooms—hopper ventilators over the doors and a fresh air inlet to every class-room, the air for all of which is taken from the south side of the building. The Headmaster spoke warmly in favour of the general scheme and arrangement of the building. Standing on the platform at the end of the great hall, practically the entire school is under his eye, the building is extraordinarily compact, and any point in it can be reached in a few minutes. The other rooms necessary to a school, such as physical and chemical laboratories, &c., are in a separate building; and as it is to a great extent a Boarding School—those who are not boarders live close by in the town or are attached to a boarding house—there is no need for any provision for cloak-rooms, lockers, dining-rooms, &c.

Streatham Hill High School.—This school for girls, the property of the Girls' Public Day School Company, is in its general scheme similar to the two foregoing buildings, but the difference in detail is considerable. In the first place will be noticed the large space devoted to cloak-room accommodation, due to the fact that it is a Girls' School. For the same reason it is necessary to have all the offices inside the building. While the class-rooms are grouped round the hall, there is only one on each floor that actually opens into it. The object of this is to keep the hall as quiet as possible. The class-rooms are all arranged on the south-west side of the hall, while the studio is provided with a north light. In order to increase the accommodation in the hall for prize-givings and other functions, the studio is so arranged with a sliding partition (see Fig. 73) that a number of people can be seated there with a view into the hall. Additional class-room accommodation has recently been added at the south-east corner, where the provision made for the purpose is shown on the plan, and the school now takes nearly 300 pupils. An interior view of the hall is shown in Fig. 77.

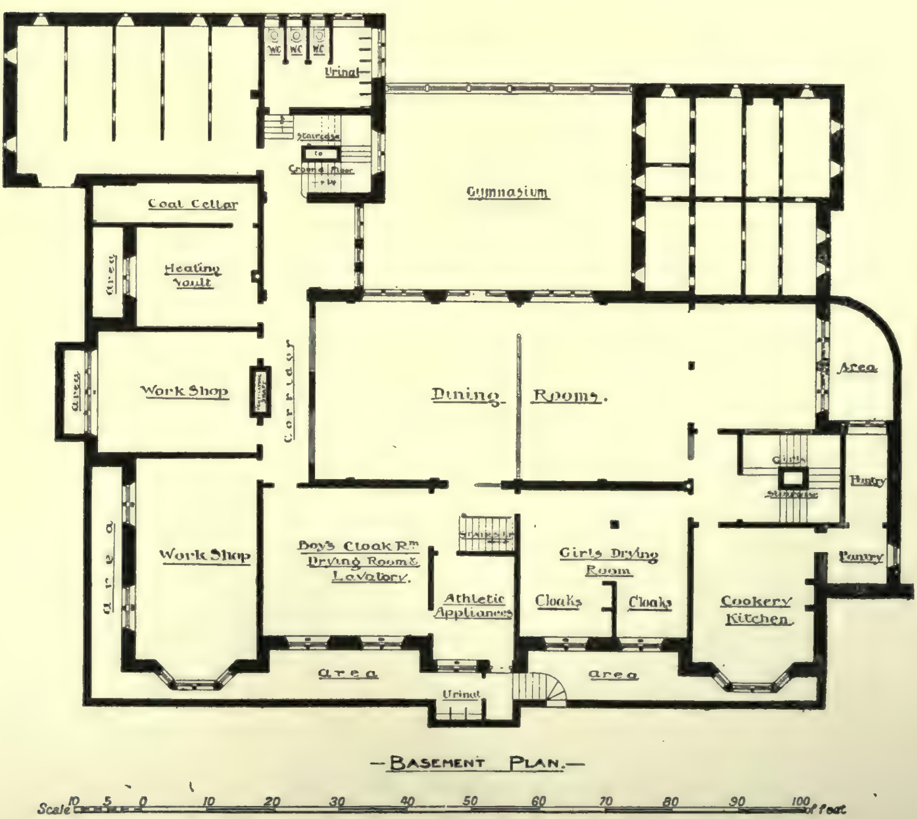
The High School, Blackburn.—Figs. 78, 79, 80 show the original design for this school; the building itself was not carried out at once in this form. These plans provide very complete accommodation for a school of about 400 girls. A covered playground and gymnasium are placed in the basement, on this floor is also placed the Kindergarten,

* This is not shown on the plan, but the position of the lavatory can be seen.

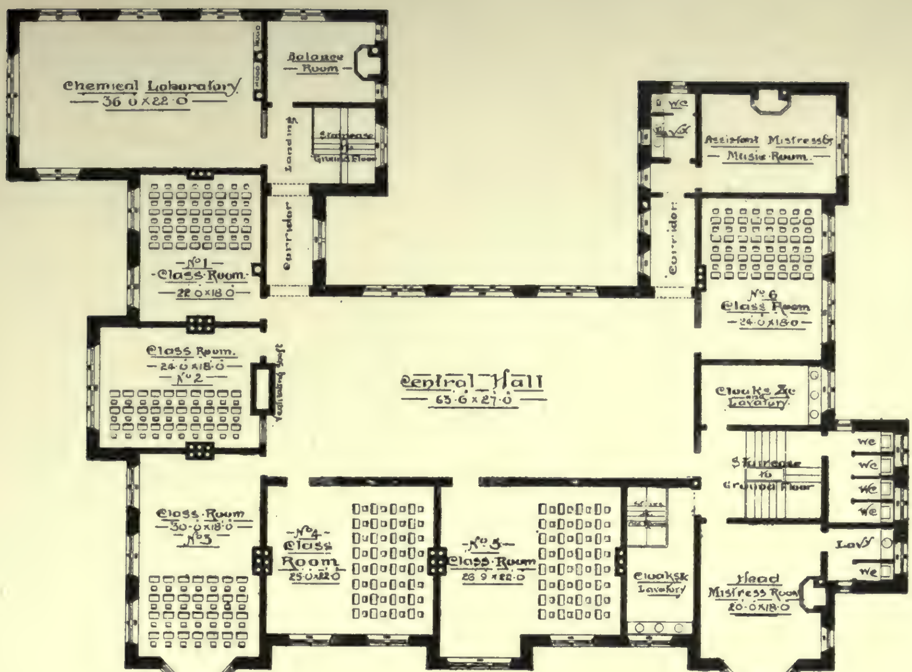


Stones & Gradwell, Architects

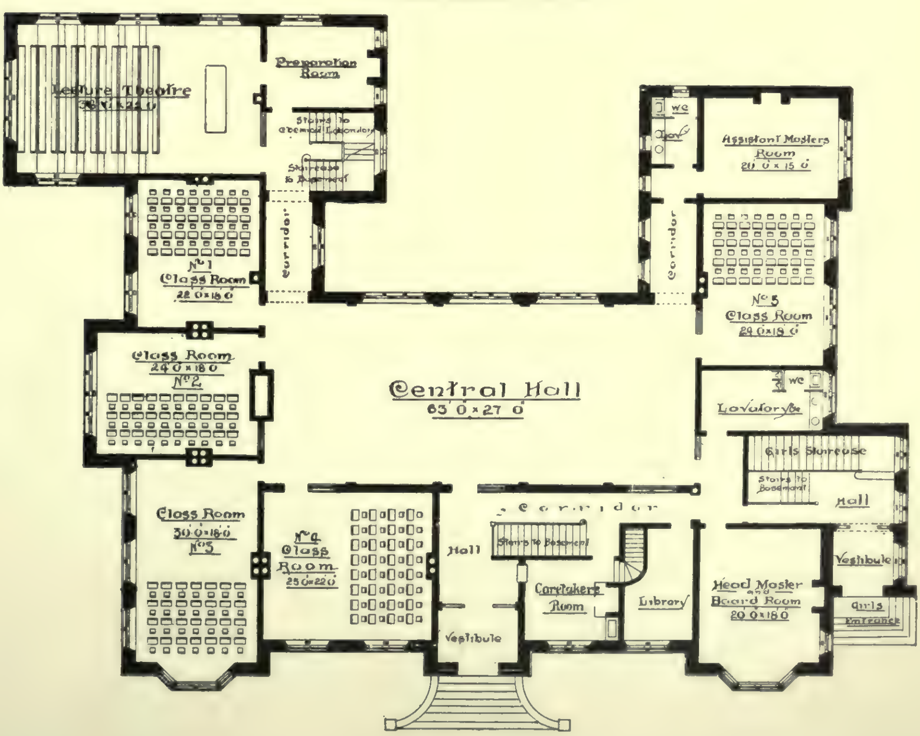
78-80. HIGH SCHOOL, BLACKBURN.



81-84. THE DEWSBU



FIRST FLOOR PLAN

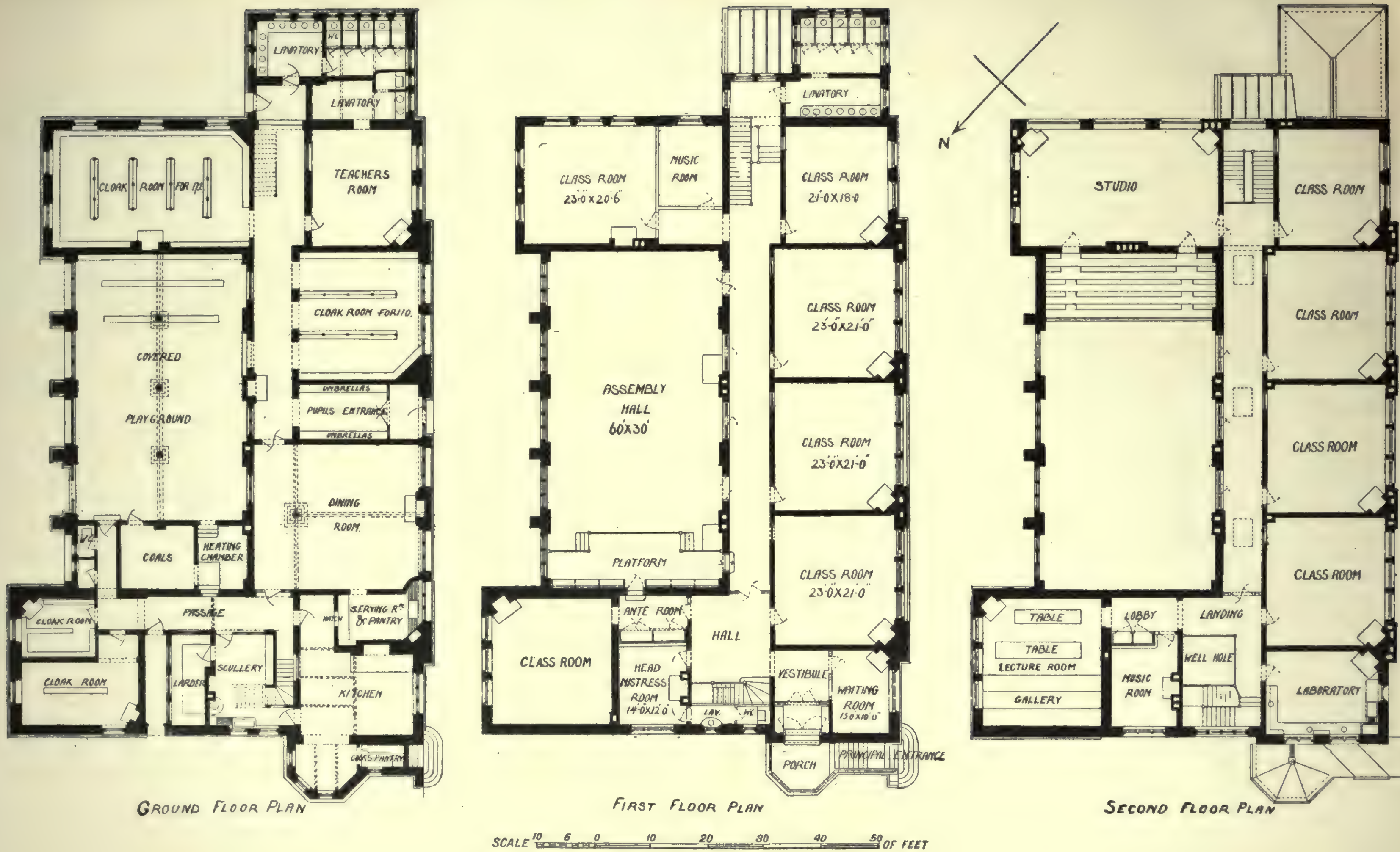


GROUND PLAN

GRAMMAR SCHOOL.

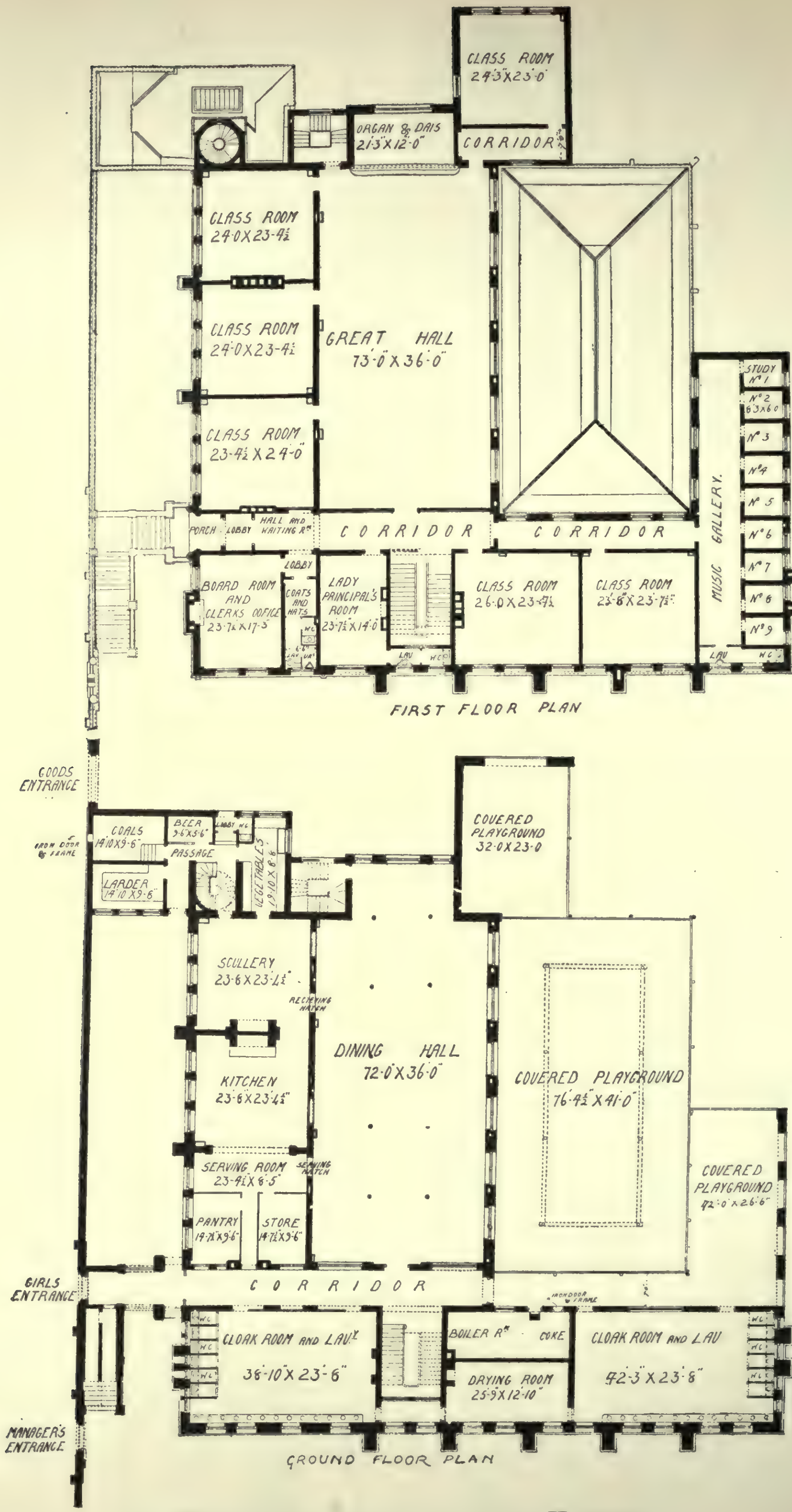
T. Lane Fox, Architect.

Between pp. 180 *and* 181.



85-87. THE HIGH SCHOOL FOR GIRLS, SHEFFIELD.

The Girls' Public Day School Company. *J. Osborne Smith & Tanner, Architects.*



88-90. ASKE'S SCHOOL FOR GIRLS, HATCHAM.

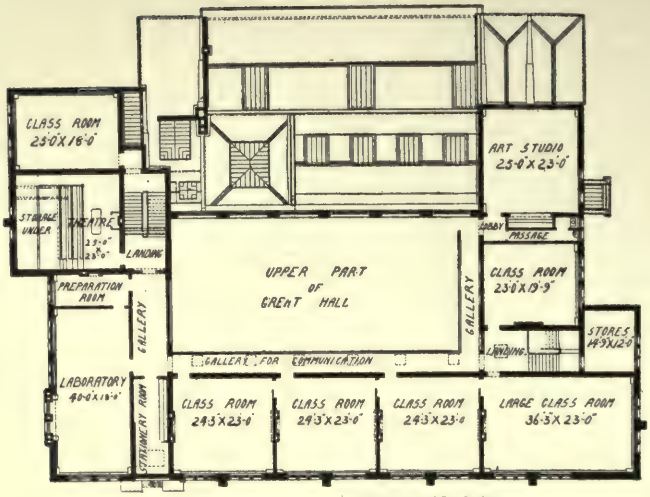
Stock, Page, & Stock, Architects.

opening directly into the garden with separate cloak-rooms, &c. The hall is placed in the centre of the building with rooms on four sides lit by windows over the class-rooms upon either side.

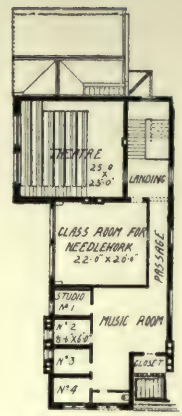
The Dewsbury Grammar School.—In Figs. 81-84 are shown the plans and perspective of a conveniently planned and well-arranged school to take some 250 pupils, girls and boys. In the basement are found drying and cloak rooms for both girls and boys, with a separate staircase for each, as well as a large dining-room, gymnasium, and workshops. The large central hall, repeated on two floors, gives direct access into all the class-rooms on three sides, being lit itself from the fourth. A staircase is provided at each end of the building.

The High School for Girls, Sheffield.—This school, also the property of the same Company, again shows a somewhat similar example to the last. By means of corridor down the side of the hall there are no class-rooms opening directly out of it, though they are all easily accessible. In this building there is a covered playground in the basement, in addition to the cloak-rooms, dining-room, kitchen, and offices. The sanitary arrangements are placed on two floors, and while easily accessible, are shut off from the building by an intercepting lobby. The rest of the arrangement of the building can be easily seen from the plan. This school has been opened some time, and has been found extremely convenient and well adapted for its purpose. The chief feature is the corridor which serves to cut the hall off from the class-rooms so that it can be used for the purpose of drilling, singing lessons, &c., without interfering with the work going on in the class-rooms. There are about 350 pupils in the school.

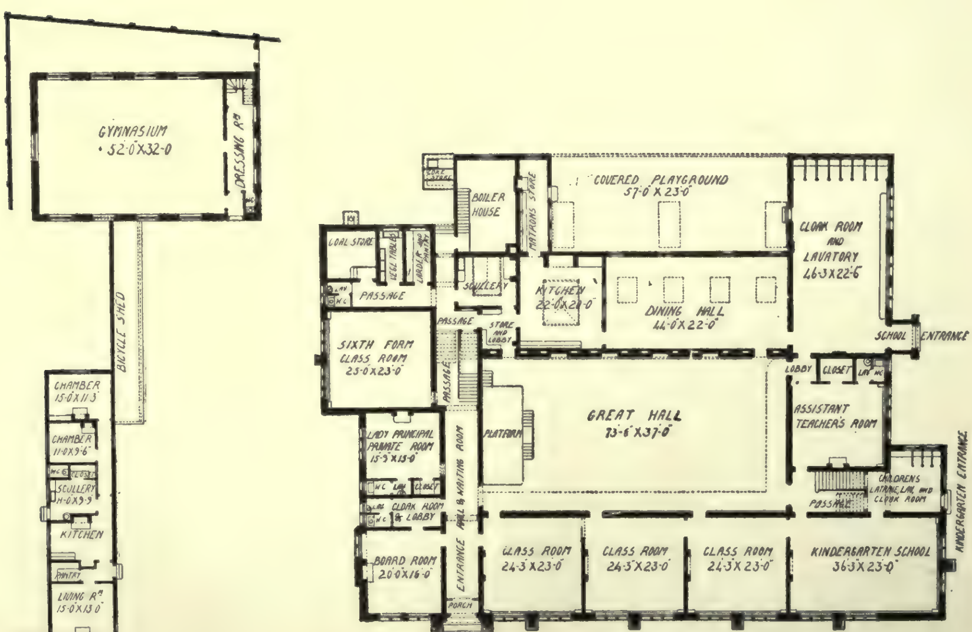
Aske's School for Girls, Hatcham.—In Figs. 88-90 and 95 is shown a school for girls built by the Haberdashers' Company at Hatcham. While keeping the arrangement of the class-rooms opening off three sides of the hall, the whole of the building is planned on a considerably larger scale as regards space than the foregoing examples. The dining-hall is the same size as the hall above, while the large covered playground is found a great boon. The music gallery with the nine practising rooms is worthy of notice. The school is well lit, Miss Conolly, the Headmistress, who had a considerable share in the arrangement and planning of the school, not only insisting on an ample supply of windows, but that the sills should be kept low, down to about 2 ft. 6 in., which, although it gives the rooms an attractive and cheerful appearance, should, I think, be regarded as



FIRST FLOOR PLAN



WEST WING SECOND FLOOR.



GROUND FLOOR PLAN

91-94. ASKE'S SCHOOL FOR GIRLS, ACTON.

Stock, Page, & Stock, Architects.

95. Aske's School for Girls, Hatcham.

Stock, Page, & Stock, Architects.

To face p. 184.

rather too low to be quite satisfactory in a school building,* but at all events they are a most pleasant and excellent change from the old fashion of having the sills 5 ft. from the floor.

Aske's School for Girls, Acton (Figs. 91-94).—This plan shows a development of the preceding arrangement, making a commodious and well-arranged school. The class-rooms are arranged on the three sides of the central hall, opening directly into the hall, but with doors so arranged that it is possible to pass from one to the other without going

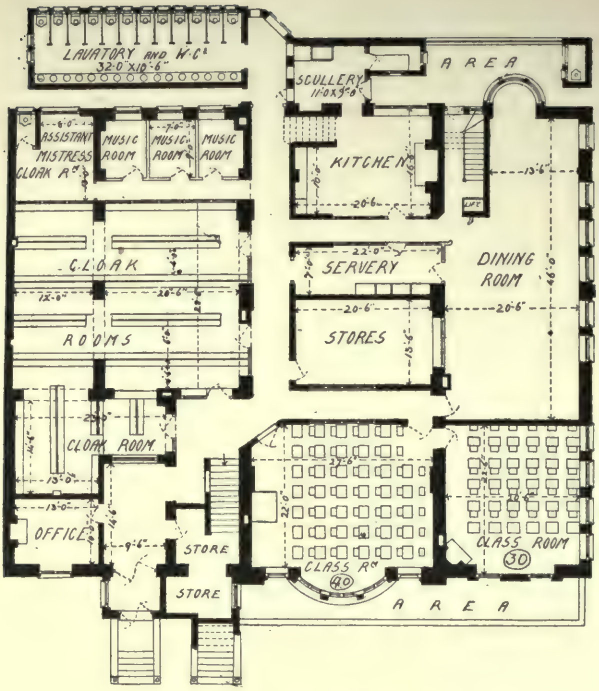
96. THE COBORN SCHOOL FOR GIRLS, BOW ROAD, E.

G. Elkington, Architect.

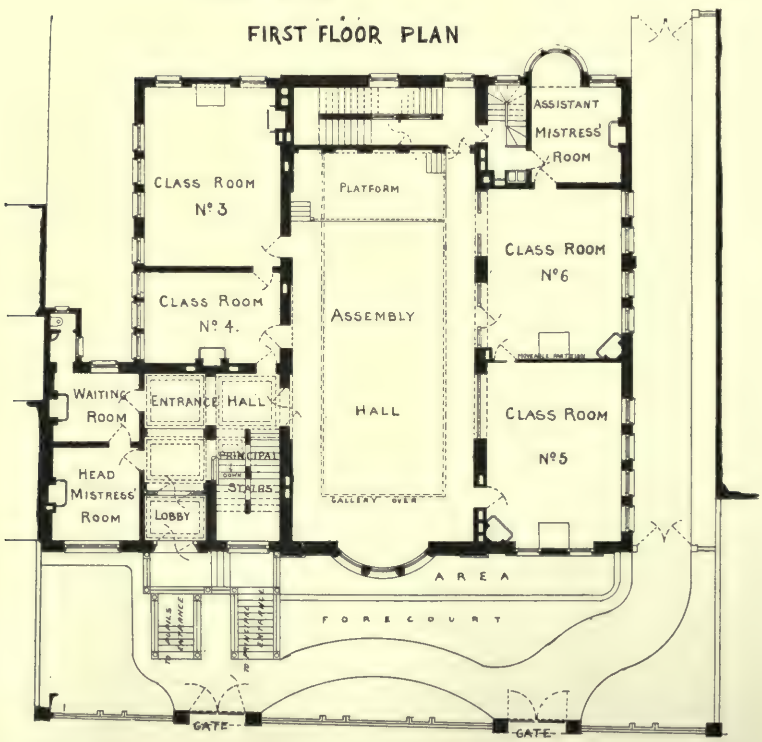
into the hall. On the ground floor are placed the cloak-rooms, dining-hall, and kitchen; the Kindergarten, with separate cloak-room and offices; form class-rooms, and the Headmistress's room, staff-room, &c. On the first floor the remaining six class-rooms, laboratory, studio, and lecture-room. There is a covered playground provided as well as a gymnasium.

The Coborn School for Girls (Figs. 96-98).—In this school, recently

* See page 111.



FIRST FLOOR PLAN



GROUND FLOOR PLAN

Scale of 10 5 0 10 20 30 40 50 Feet

97, 98. THE COBORN SCHOOL FOR GIRLS, BOW ROAD, E.

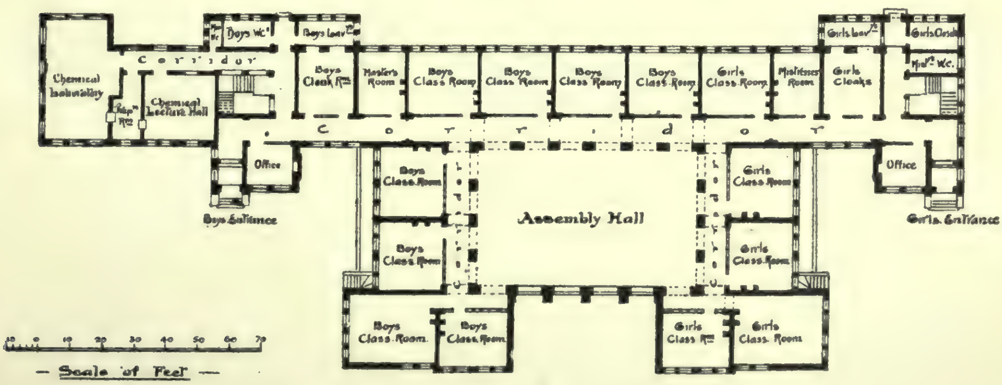
Stepney and Bow Foundation Schools. *G. Elkington, Architect.*

erected in the Bow Road, E., the basement is occupied by a large cloak-room, the dining-room, and kitchens; two class-rooms being placed at the south-east end. The entrance to the school for the pupils

99. The Hulme Grammar School.

J. W. Frith, Architect.

leads directly to the cloak-room, a different staircase giving access to the school. On the ground floor, the class-rooms on one side are so arranged that they can, if necessary, be thrown into the hall. On the first floor the access to the class-rooms is arranged by means of a



100. The Hulme Grammar School. Plan.

gallery running round all four sides of the hall; this is of considerable depth at the end opposite the platform, so that considerable seating accommodation is gained. It will be noticed that in one or two class-

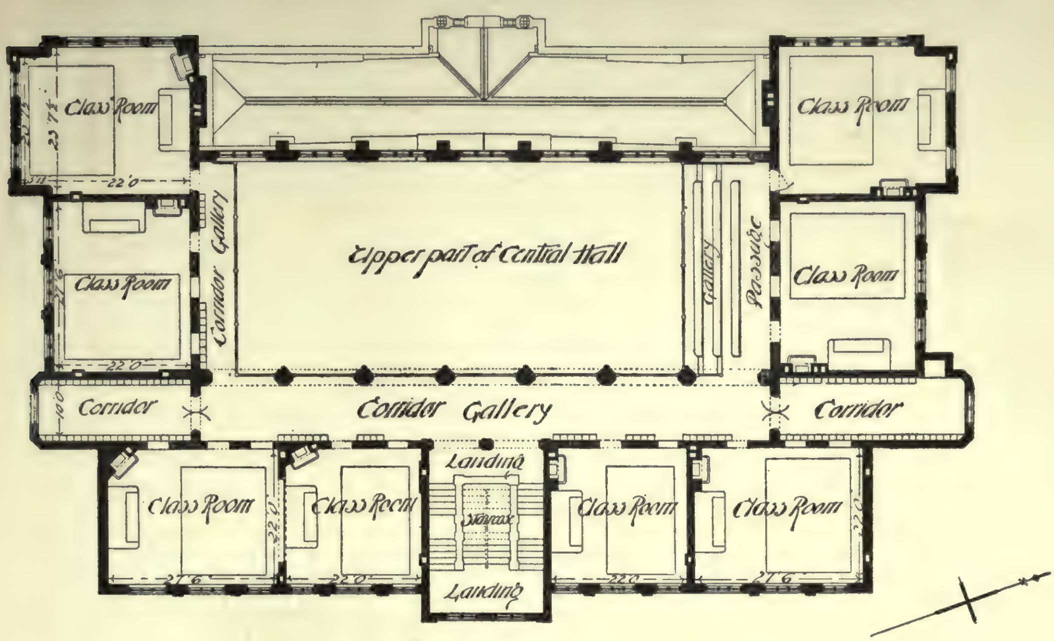
rooms there are windows placed behind the teacher, which cannot be considered a desirable arrangement.

Hulme Grammar School.—Figs. 99 and 100 show the ground plan of a large Grammar School for boys and girls. By means of an arcaded corridor running round three sides of the hall there are thirteen class-rooms so arranged that the entrances to all of them are commanded from the assembly hall. It will be noticed what a large proportion the window space has to the wall space, the latter being reduced to merely narrow piers between the windows.

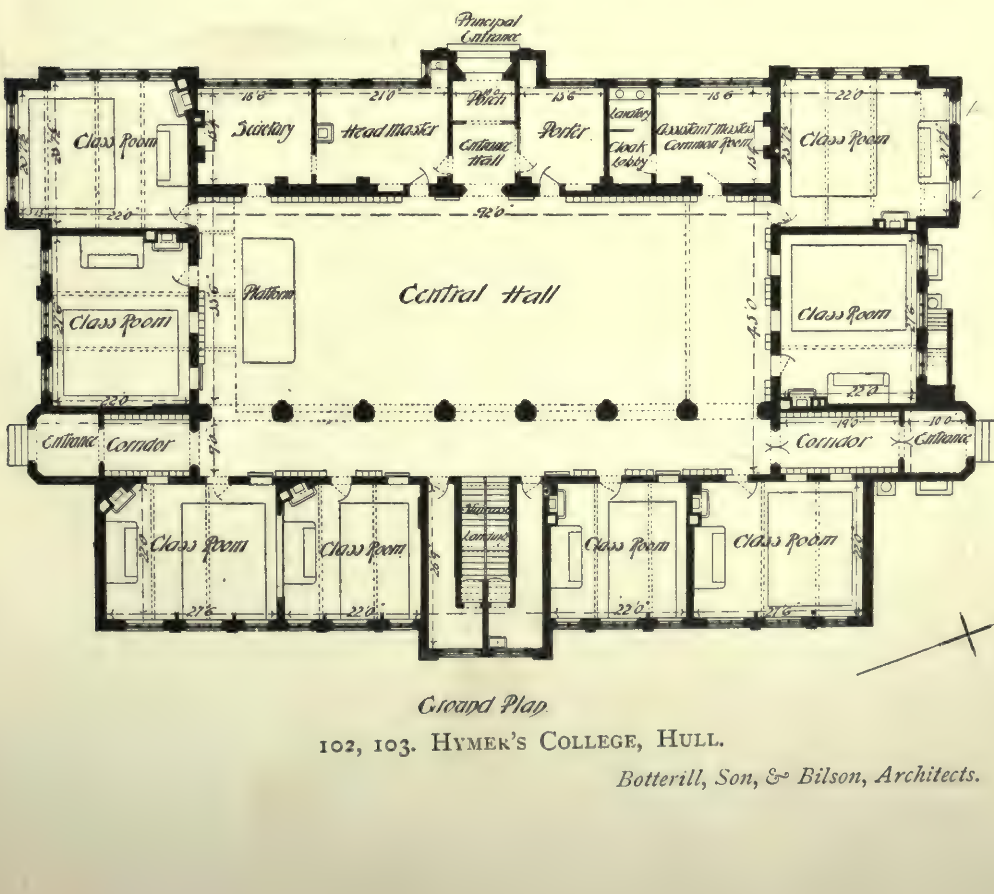
101. Hymer's College, Hull.

Botterill, Son, & Bilson, Architects.

Hymer's College, Hull.—The plans of this building are shown in Figs. 102 and 103, with a photograph of the exterior (Fig. 101). The class-rooms are arranged on three sides of the hall, an arcaded passage being provided for communication. The Headmaster's room, offices, and assistant masters' room are arranged on the entrance front. This part of the building is only carried up one floor, so that the windows for lighting the hall can be placed over it. Lockers are placed in the corridors at each end of the hall. Eight class-rooms are arranged on each floor,



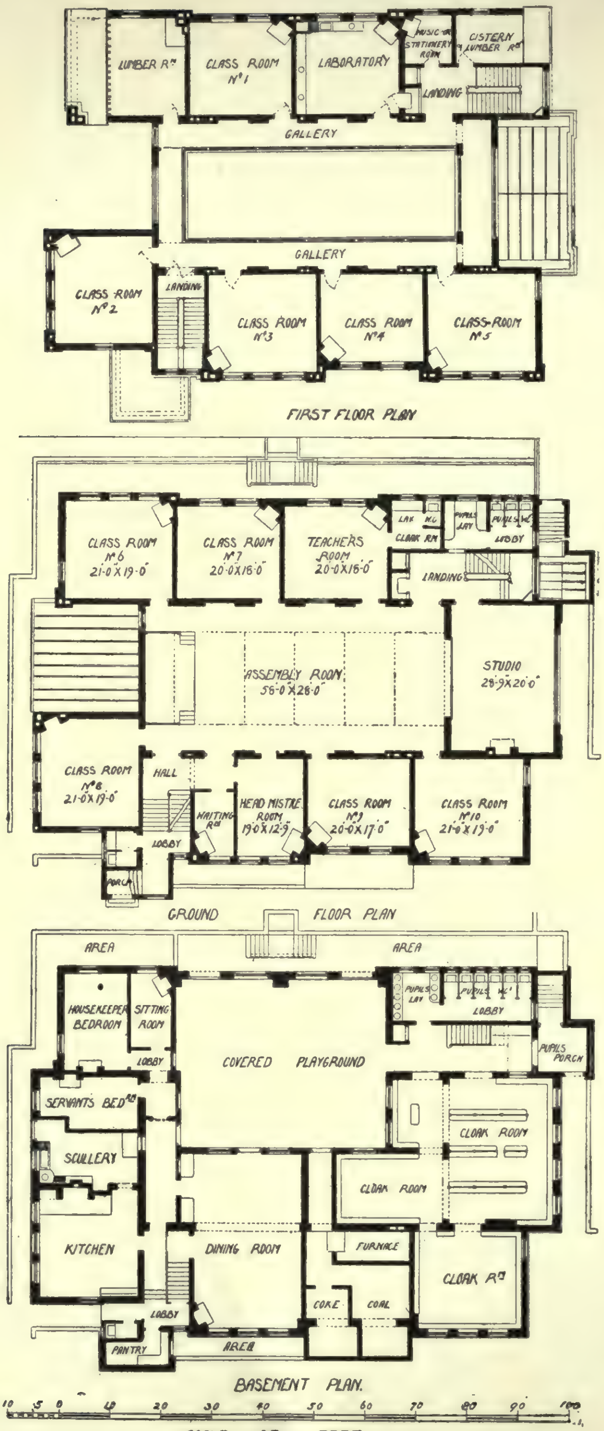
First Floor Plan



Ground Plan

102, 103. HYMER'S COLLEGE, HULL.

Botterill, Son, & Bilson, Architects.



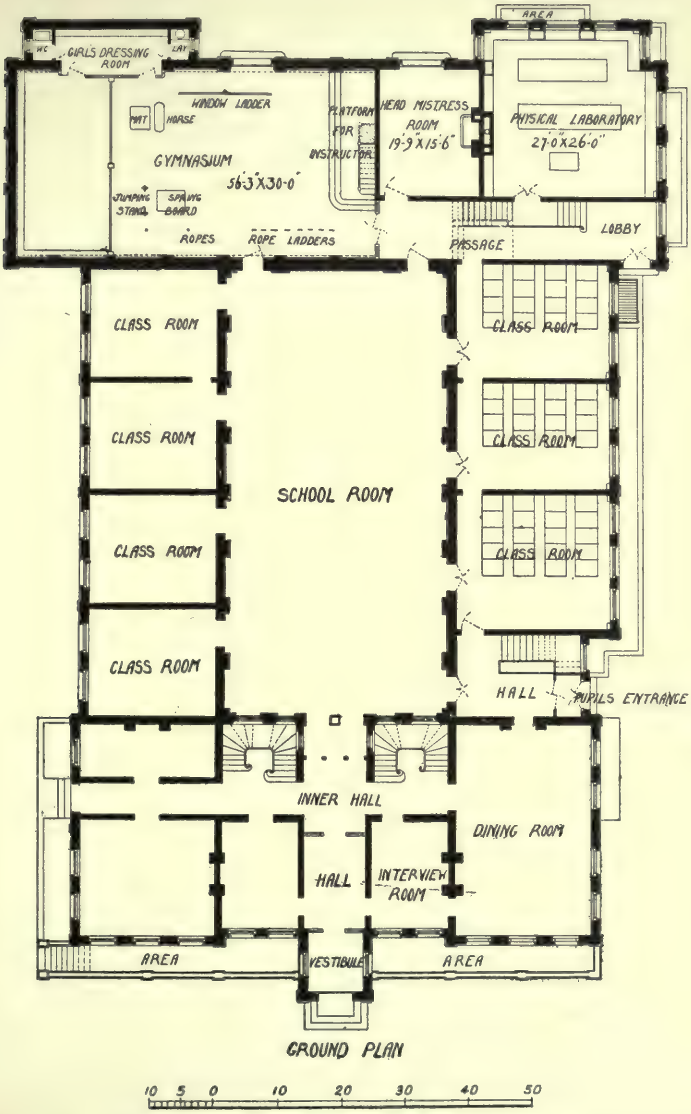
104-106. Wimbledon High School for Girls.
The Girls' Public Day School Company.
J. Osborne Smith, Architect.

but only one staircase is provided, which seems hardly sufficient for a school of this size. It will be noticed that all the class-rooms are well lit, and of considerable size.

The Wimbledon High School (Figs. 104-106).—All the previous examples are schools in which the class-rooms are placed on three sides of the central hall. The next example shows the arrangement of a building with rooms on the four sides of a hall, lit from the top. This school is an interesting example of economical planning, there being no corridors and no wasted space, while room has been found for a covered playground and ample cloak-room accommodation in the basement. On the ground floor the studio can be thrown into the hall when additional space is required, access to the class-rooms on the first floor being provided for by means of a gallery. Though a certain amount of disturbance is caused in the class-rooms by a plan of this kind whenever anything of a noisy nature is going on in the hall, the ease of supervision and compactness

of the building are highly spoken of, and from an economical point of view the superiority is marked.

Stamford Hill (Fig. 107).—This shows another example of a hall



107. The Stamford Hill High School, showing Additions.

W. Campbell Jones, Architect.

with rooms opening off it on all sides. As originally built there were class-rooms on one side only, but a recent addition carried them all round, a gymnasium being also arranged at one end.

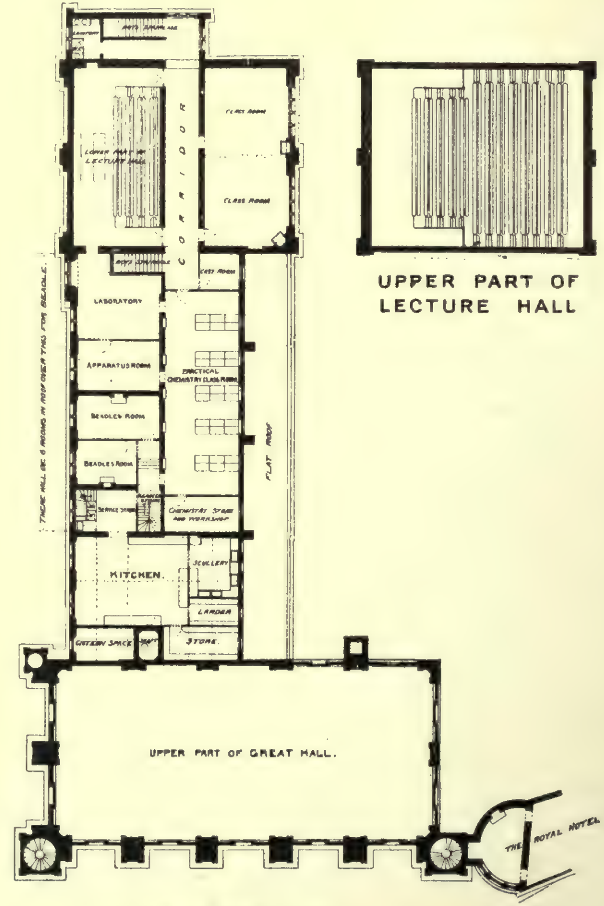
The City of London School (Figs. 108-111).—All the previous examples are various types of the central hall system. It is now proposed to give some examples of schools in which the hall is treated as a separate room, with no connection with the class-rooms. The best known if not the best example of this type of plan is that of the City of London School. The architects were selected by a competition in which fifty-three took part. The essential feature of the plan consists of a long corridor with class-rooms opening off it on two sides, the hall being situated at one end. The administrative rooms, library, Headmaster's room, &c., are arranged on the ground floor, above them being the great hall running through two stories. Underneath on the basement level is placed a covered playground on a level with the playground, in which are placed the offices, fives court, and gymnasium. The basement floor is taken up with the dining-room and extensive cloak-rooms, through which the pupils gain admittance into the building. The class-rooms, of which there are twenty, are all of one size, viz., 24 ft. by 22 ft., and are intended to take 40 boys as a maximum number. Their height is 14 ft. 6 in. These rooms are heated by ventilating grates (Boyd's) in addition to two Tobin's tubes, while the extract ventilation is provided for by means of a horizontal air passage 3 ft. deep, formed along the top of the corridors, the ceilings of which are thus lower than those of the class-rooms by that amount. These are connected with a tall upcast shaft from the furnace in the basement. Each class-room has two openings into the duct. On the top floor ample facilities for science teaching are supplied, including a large lecture-room. The kitchen is also placed on this floor with a lift down to the dining-room, which is placed in the basement. There are two staircases in addition to the principal stair which leads to the great hall. A useful feature and one worthy of notice is the provision of two turret staircases leading to the dais at the end of the hall, one leading from the committee-room and one from the sixth form library, a most convenient arrangement when any function is taking place in the hall. The hall itself measures 100 by 45 ft.

St Paul's, West Kensington.—As another example of a large Day School for boys there is illustrated in Figs. 112-114, St Paul's School, West Kensington. This building is also arranged on the principle of a long corridor with the rooms opening off it. In this, on the ground and first floor are arranged the boys' lockers, each boy in the school having one fitted with lock and key. The great hall, measuring a little over 80 ft. in length by 43 ft. in breadth, is situated on the ground floor. This hall has been found to be hardly large enough for the size of the school.

— PLAN OF GROUND FLOOR. —

10 5 0 10 20 30 40 50 60 70 80 90 100

Scale of feet

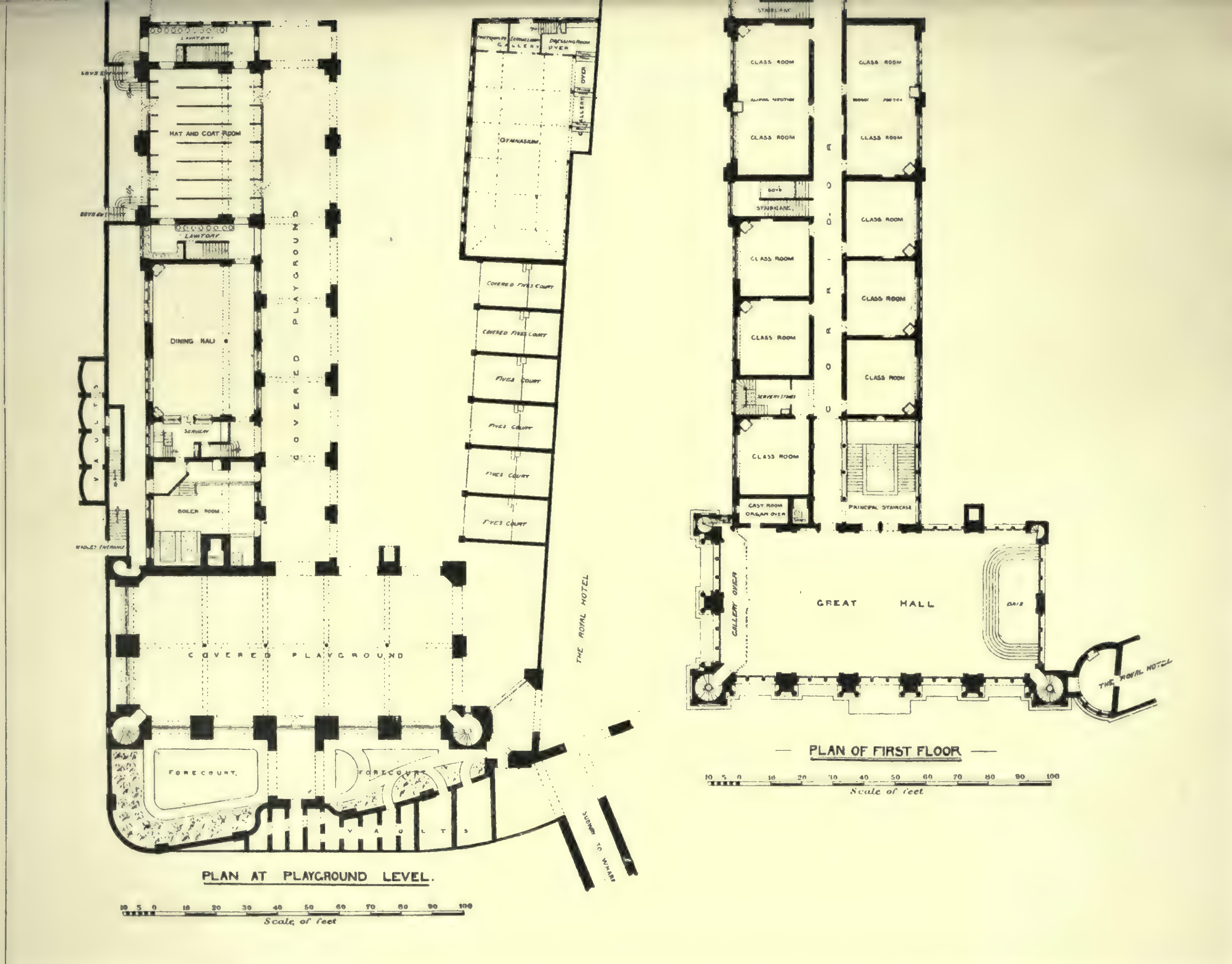


— PLAN OF SECOND FLOOR. —

10 5 0 10 20 30 40 50 60 70 80 90 100

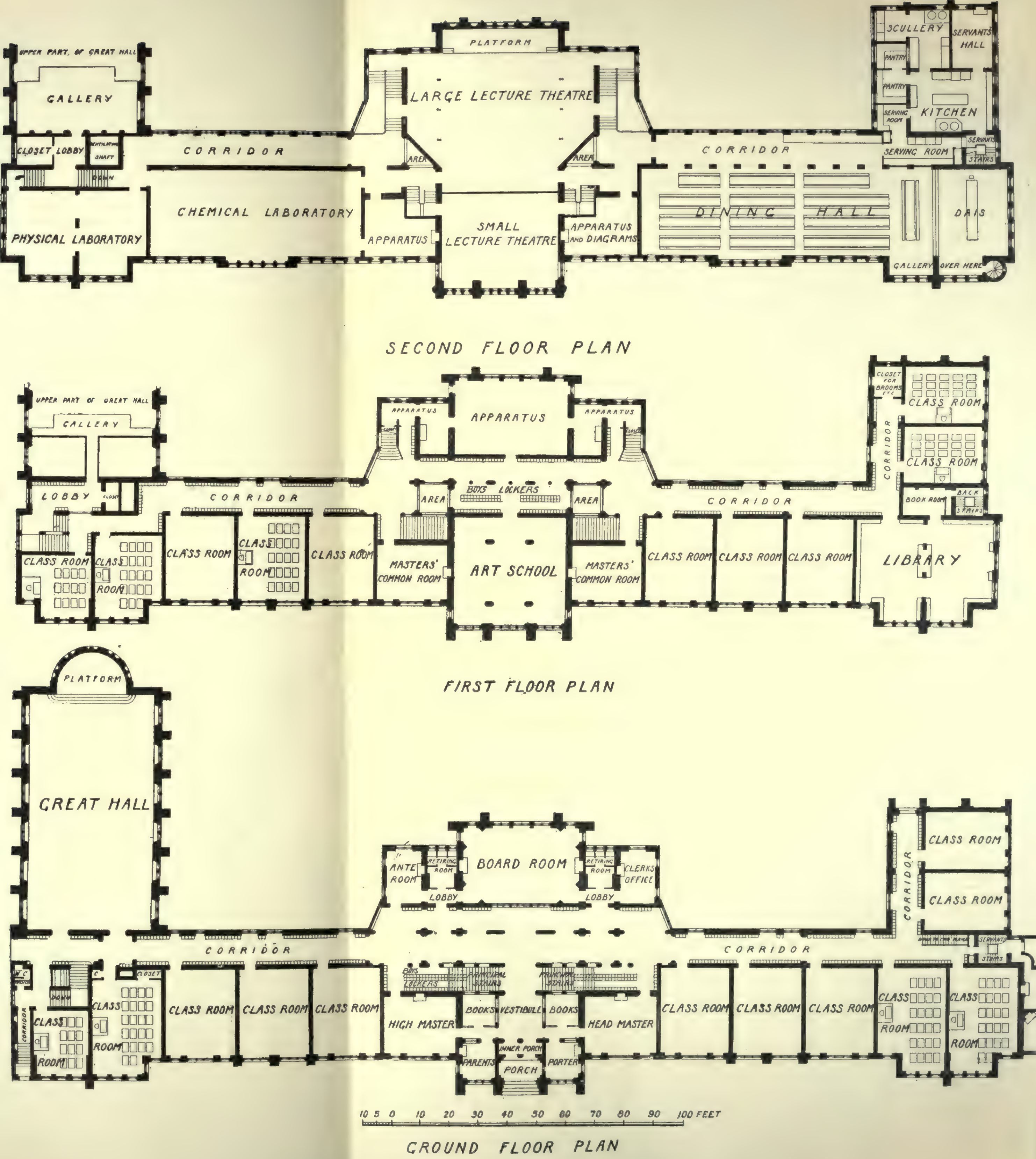
Scale of feet

UPPER PART OF
LECTURE HALL



108-111. THE CITY OF LONDON SCHOOL.

Between pp. 102 and 103 *Davis & Emanuel, Architects*

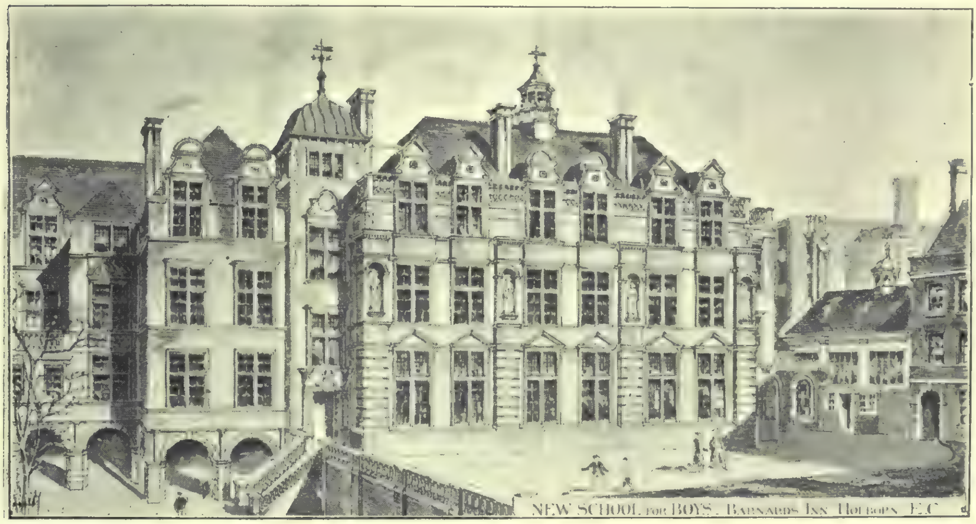


112-114. ST PAUL'S SCHOOL, WEST KENSINGTON.

To face p. 193. *A. Waterhouse, R.A., Architect.*

The class-rooms, of which there are twenty-two, were originally designed to hold 40 boys, but as has been already mentioned, the school is very highly staffed, and few forms reach as large a size as 20 pupils. The top floor is devoted to science teaching, and to the dining-room, kitchens, &c. The chemical laboratory is a very fine room, and can accommodate, if necessary, about 50 pupils at work on practical chemistry at the same time, while near to it is a very large lecture-room. The dining-room and kitchen are particularly worth notice for the convenience of their arrangement.

The plan of this school is rather suggestive of the arrangement of a German Gymnasium, and would probably serve better for a school

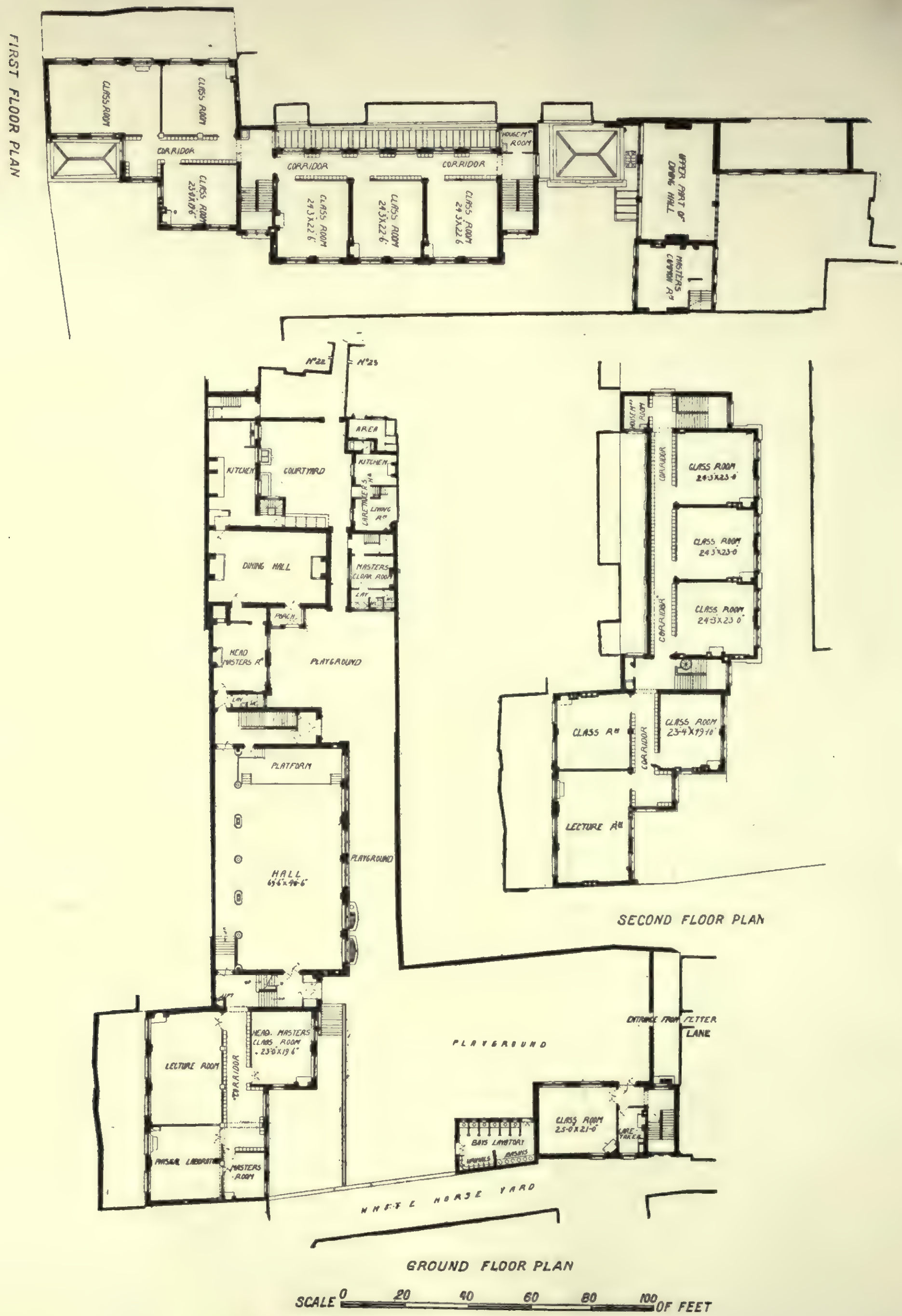


115. The Mercers' School for Boys, Holborn.

The Mercers' Company. *T. Chatfield Clarke & Son, Architects.*

organised on Continental lines than for an English School, where it is customary to collect the school once or twice every day in the central hall. The class-rooms are placed on one side only of the corridor, so that it is a long way from the farther rooms to the great hall, the entrance to which is also rather cramped for the rapid movement of large numbers. The class-rooms are large and excellently lit.

The Mercers' School for Boys, Holborn (Figs. 115-118).—This school, formerly situated at College Hill, was in 1892 removed to its present site in Barnard's Inn. It is an interesting example of a school planned on an awkward site. The old Inn Hall has been retained to serve the purpose of a school dining-hall, the kitchens having been



116-118. School for Boys, Barnard's Inn.

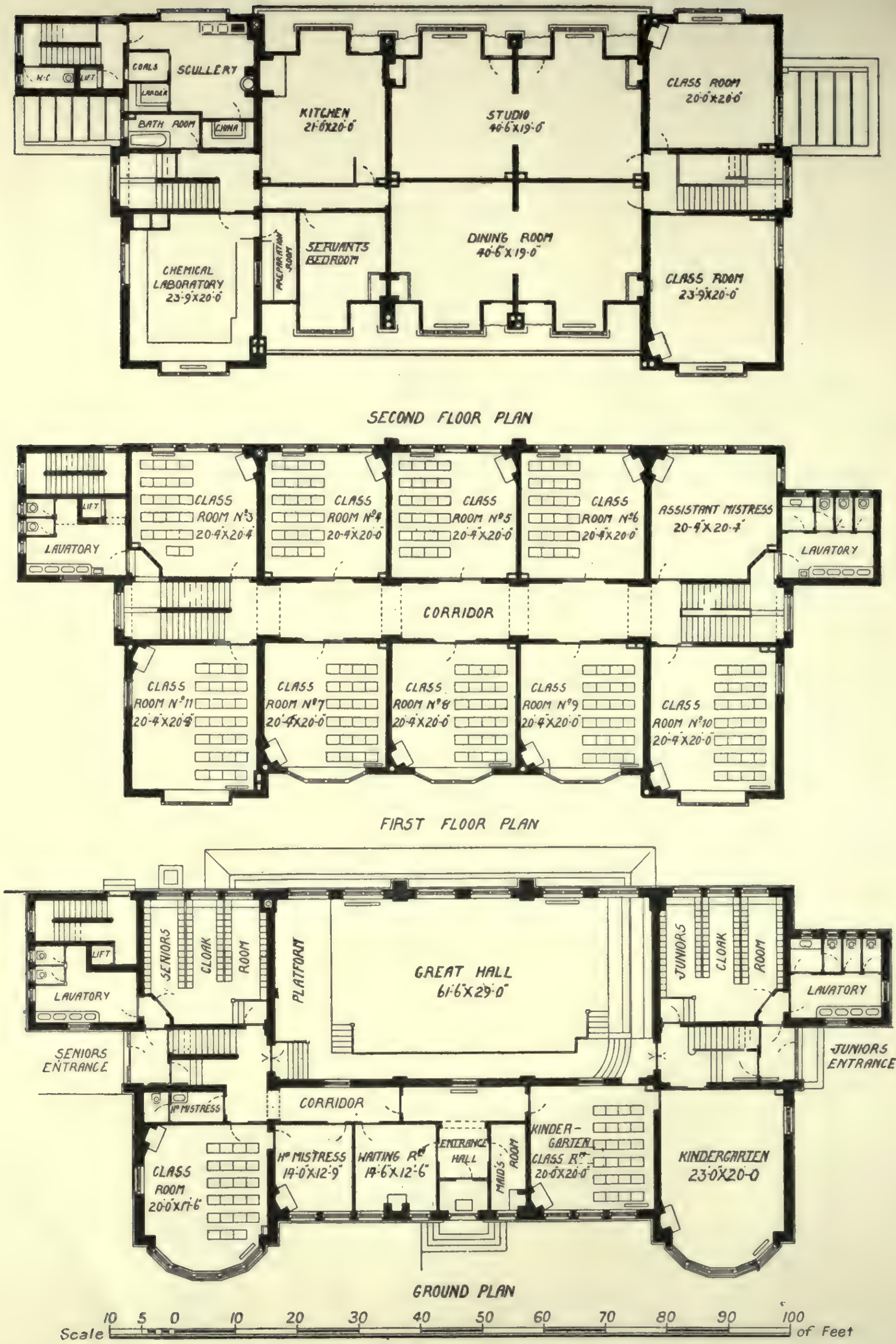
The Mercers' Company. *T. Chatfield Clarke & Son, Architects.*

arranged in connection with it. The school itself lies behind this, a room for the Headmaster having been arranged close to the end of the hall, with a door on to the back of the stage. There is a large and handsomely decorated hall measuring some 70 ft. in length. By utilising a narrow piece of waste ground down the side of the hall, upon which no building of any height could be placed owing to some old rights of light, the architect was able to provide an arcaded corridor to serve as a passage to the rooms beyond. A locker for each boy is provided, these lockers being placed along the corridors, as in the case of St Paul's School mentioned above. Over the hall are placed three class-rooms on both the first and

119. THE HIGH SCHOOL FOR GIRLS, NEWCASTLE.

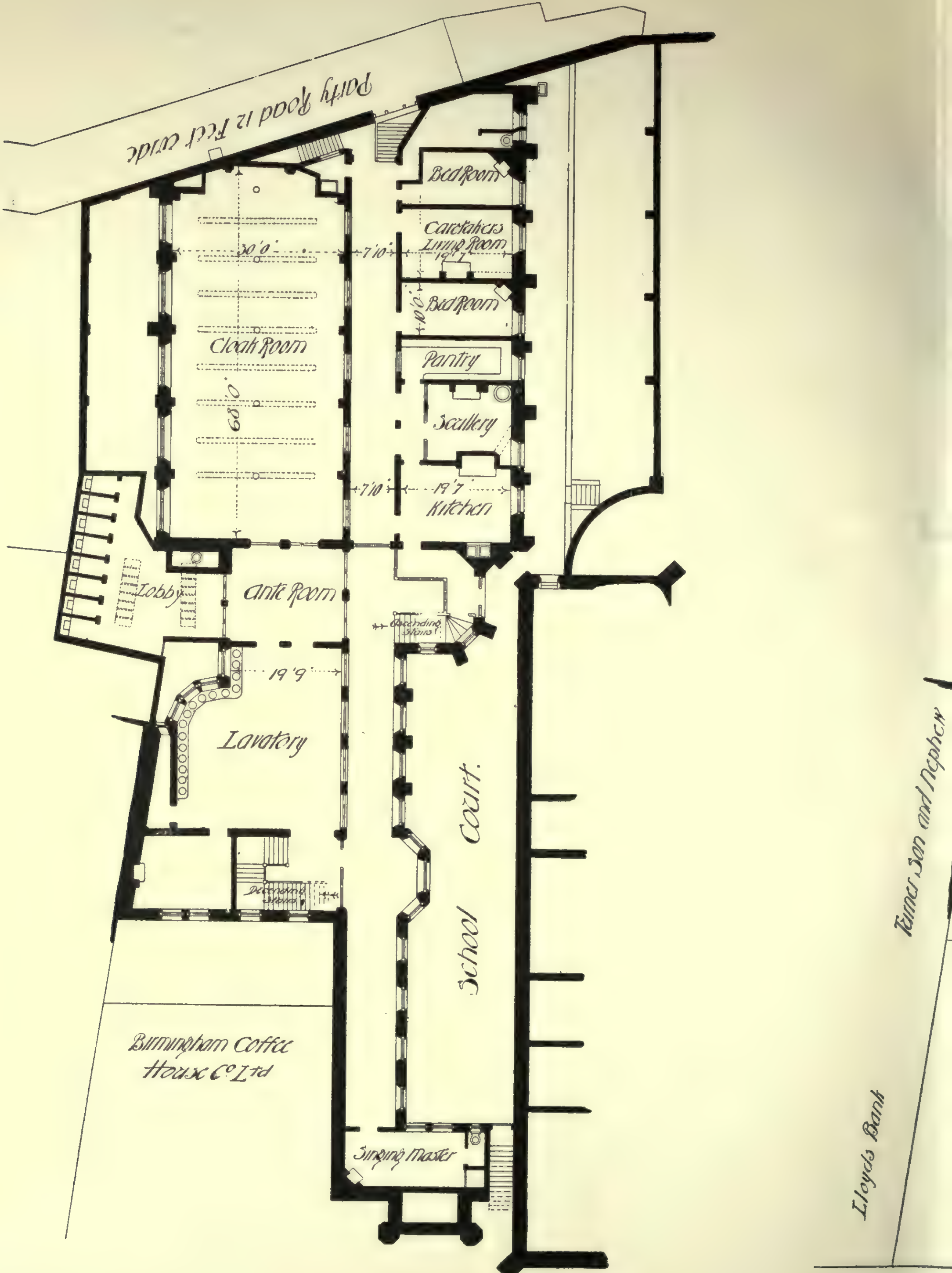
The Girls' Public Day School Company. *Oliver, Leeson, & Woods, Architects.*

second floor, the remaining rooms being in a block at the end, under which is a covered playground for use in wet weather. The school has accommodation for 300 boys. The block of buildings have been carefully placed in order to interfere as little as possible with the playground. In the corner is placed a building of three floors. The room on the ground floor could serve as a class-room if required, but is used now for a lunch-room for those boys who bring their own lunch with them, and where they can be supplied with tea and coffee by the caretaker, who has a room next door. Above this is a well-fitted chemical laboratory for practical work, the physical laboratory being in the main



120-122. THE HIGH SCHOOL FOR GIRLS, NEWCASTLE.

The Girls' Public Day School Company. *Oliver, Leeson, & Woods, Architects.*

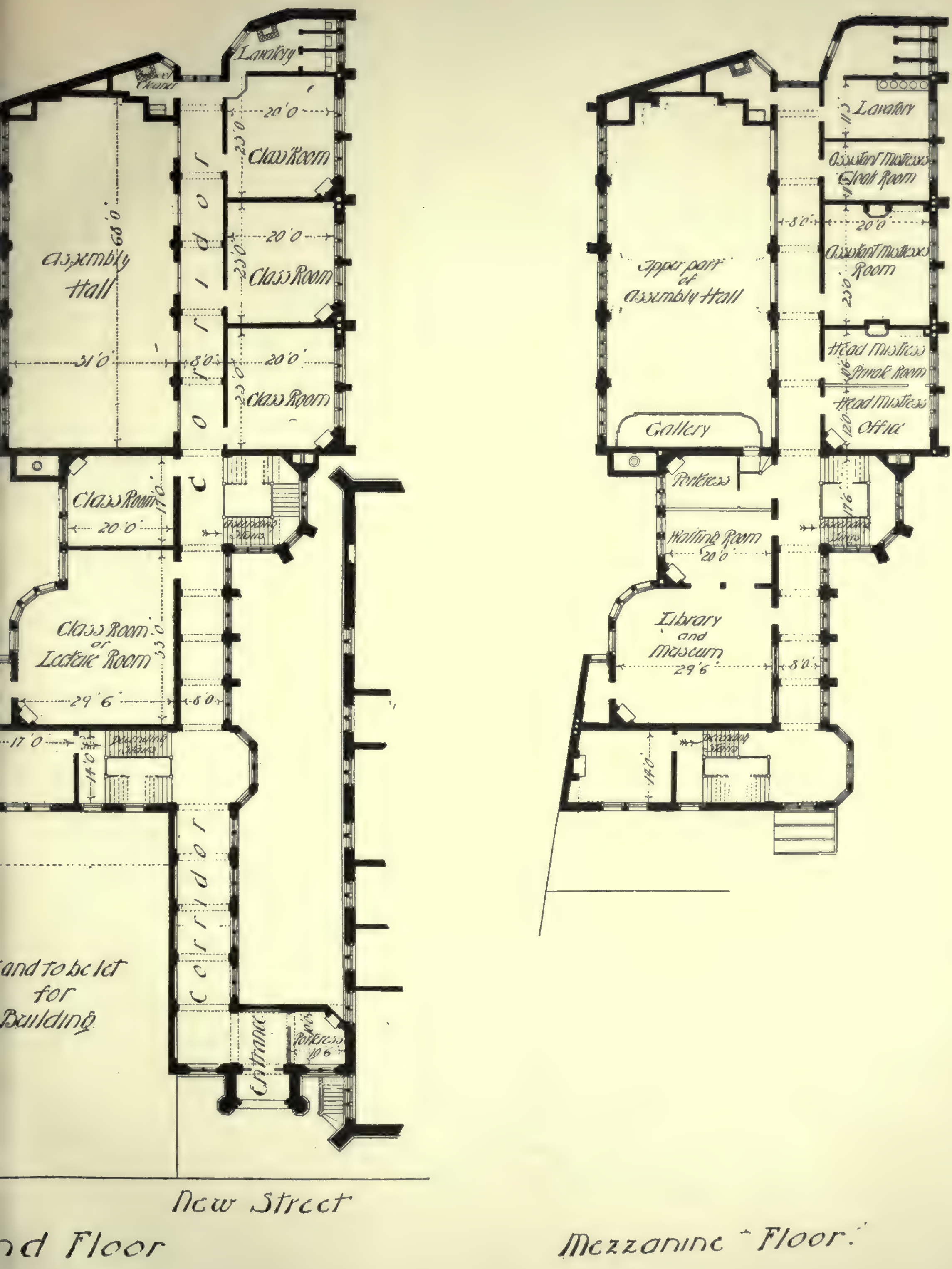


Basement Floor

10 5 0 10 20 30 40 50 60 70 80 90 100
SCALE OF FEET.

Gro

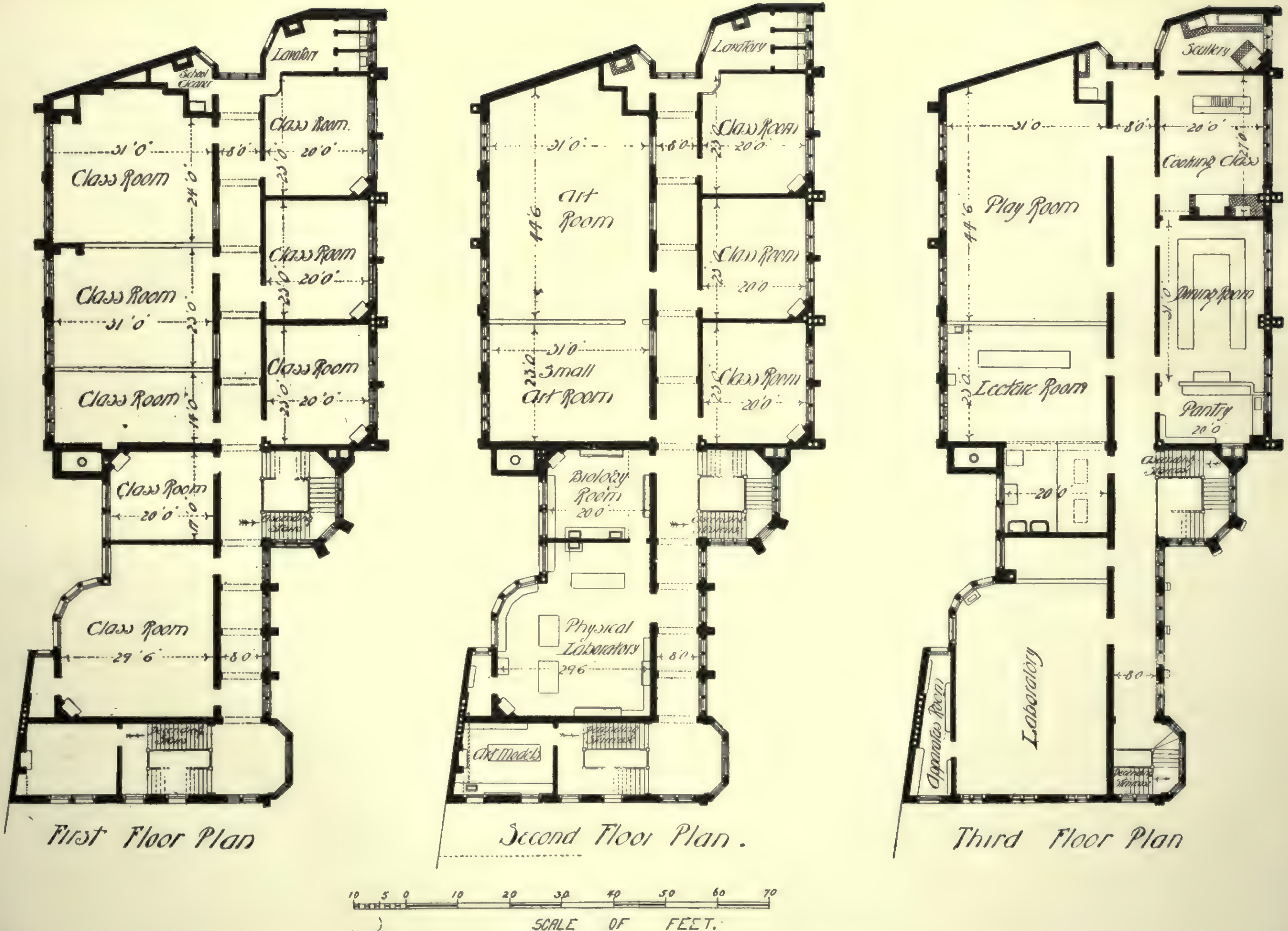
123-125. BIRMIN



AM HIGH SCHOOL.

J. A. Chatwin, Architect.

Between pp. 196 and 197.



127-129. BIRMINGHAM HIGH SCHOOL.

J. A. Chatwin, Architect.

To face p. 197.

building. On the top floor is placed a studio. The class-rooms measure 24 by 23 ft., and as they are not intended to take more than 30 boys, they provide ample room ; they are lit by electric light.

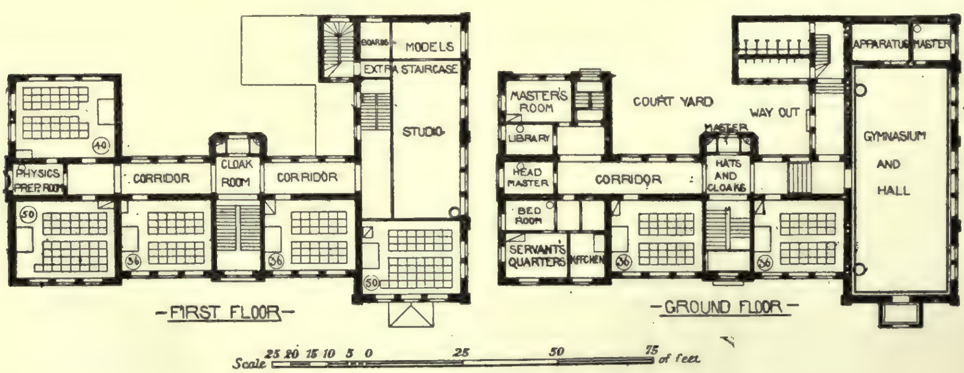
High School for Girls, Newcastle.—This school (Figs. 119-122), recently erected by the Girls' Public Day School Company, shows a school arranged with the dining-room and kitchen upon the top floor. The main bulk of the class-rooms are placed upon either side of a wide corridor on the first floor. This is lit from the ends as well as by borrowed light from the class-rooms, and as the doors of the class-rooms are glazed, the Headmistress can easily supervise the work of the school. The cloak-rooms are placed in two divisions for the senior and junior department of the school. This has been found a convenient school in practice, and is very economically arranged.

The High School for Girls at Birmingham (Figs. 123-129).—Another example of a school on a restricted site is that of the High School for Girls (Edward VI. Foundation) at Birmingham. This is a very completely equipped school, a very liberal allowance in the way of rooms and space having been given. In order to provide enough area, it has been necessary to carry the building to a considerable height. It consists of six floors, one of which, a mezzanine floor, is not used for educational purposes, and is consequently of less height. Owing to the somewhat awkward and very restricted nature of the site, it was not possible to provide any playground. The girls are, however, able to use the large gymnasium belonging to the Boys' School next door at certain times. In the basement, besides the living quarters for the caretaker, are the cloak-rooms, lavatories, and offices. The arrangement of these is particularly worthy of notice. There is a staircase down by which the pupils enter the building. When they have taken off their boots and cloaks, they enter the school part of the building by another staircase, so that no dirt is brought into the building. Both the lavatories and the cloak-rooms are spacious, making supervision easy, and avoiding all chance of crushing and confusion. Owing to the shape of the site there has to be a corridor to the entrance. This is carried right through the building, with the rooms opening off it on either side. One staircase is used for ascent and one for descent. Above the ground floor is a mezzanine, in which are placed all the rooms for the accommodation of the staff, as well as the library. Above this on two floors are found the remainder of the class-rooms. There are very complete facilities for science work, the teaching of which is made a considerable feature in the school. On the top floor, in addition to the chemical labora-

tory, is the dining-room and kitchen, and the cookery instruction room, which is fitted with an ingeniously arranged demonstration table having a gas stove in the centre. On the top floor is also a large room which is used as a playroom during the intervals, &c. This room, always useful, is in this school almost a necessity, since there is no playground. A feature worthy of notice is the service-room for cleaning purposes on each floor, with both hot and cold water laid on. Lavatory accommodation is also provided on each floor. This again is rendered necessary by the great height of the building.

The High School for Girls, Manchester (Figs. 130-133).—This is an interesting example of a school planned on the corridor system. The most noticeable feature in this building is the arrangement of the cloak-rooms. This has already been described, and need not be discussed again here, but it should be pointed out what a very large amount of space is required for this scheme of cloak-rooms. In this particular case these cloak-rooms would, if all thrown into one, make a room measuring 100 by 36 ft. There are large playrooms placed in the basement. These are used for drilling, gymnastics, &c. The equipment for science teaching is on a liberal scale and well arranged.

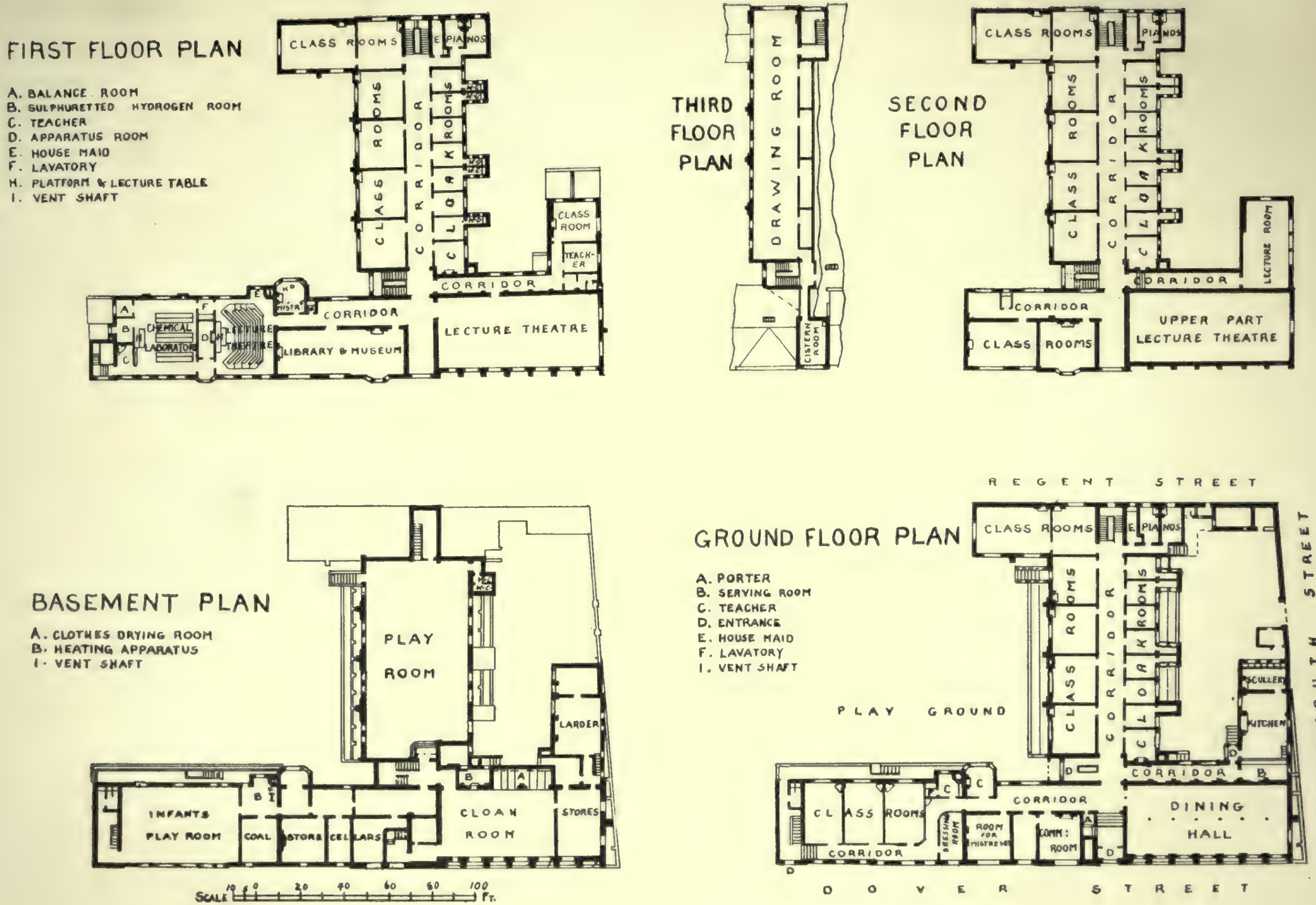
The Judd Commercial School (Figs. 134, 135).—This school, with class-room accommodation for about 150 boys combined with a house for the Headmaster, is planned so that the hall acts as a disconnection between the masters' rooms and the school, the six class-rooms being grouped at the end of the hall. A changing room is provided.



136, 137. A German School. Realschule.

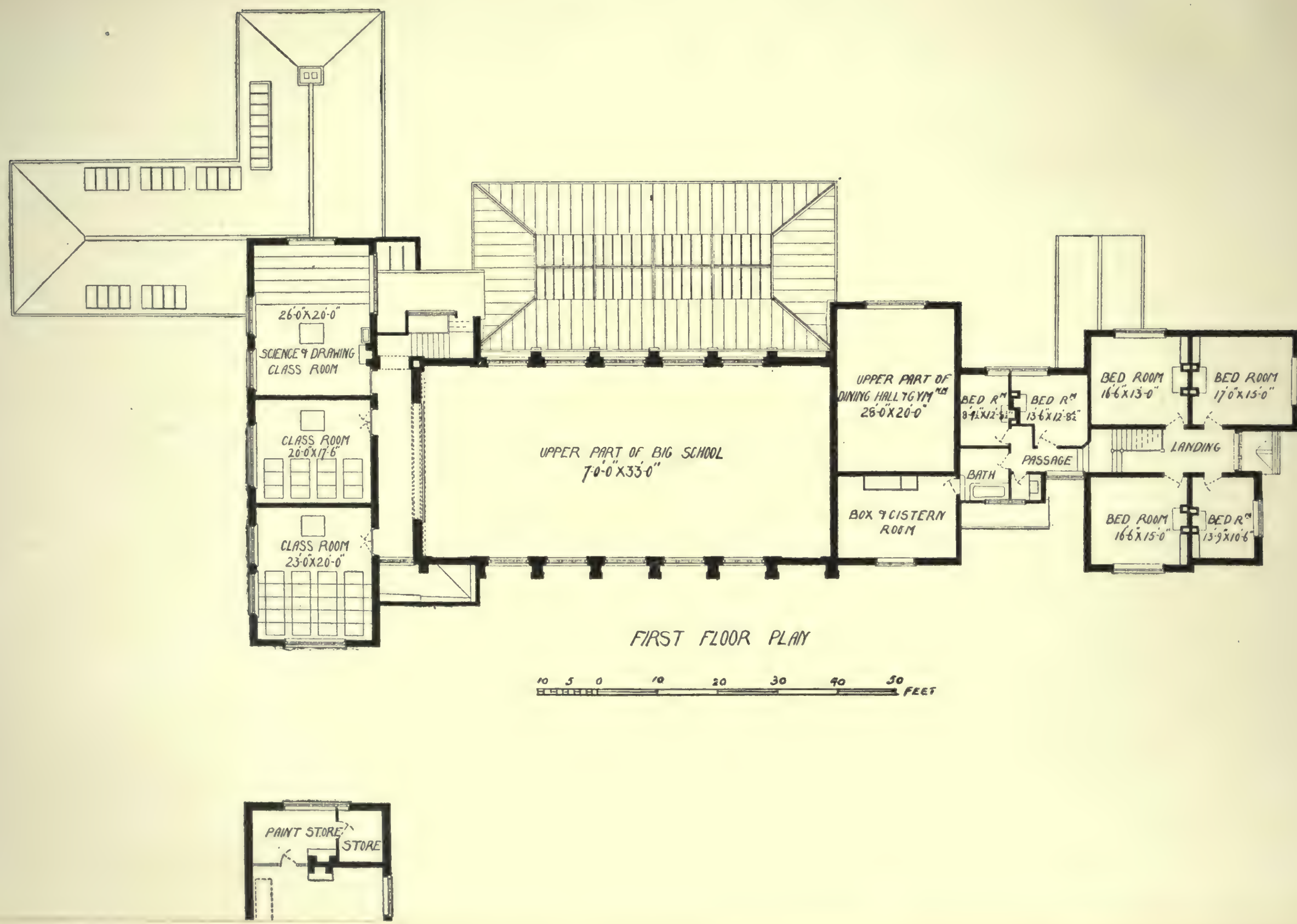
Reinold Faber, Architect.

German Schools.—Figs. 136, 137, show a small and compactly arranged building for a Realschule with seven class-rooms of various

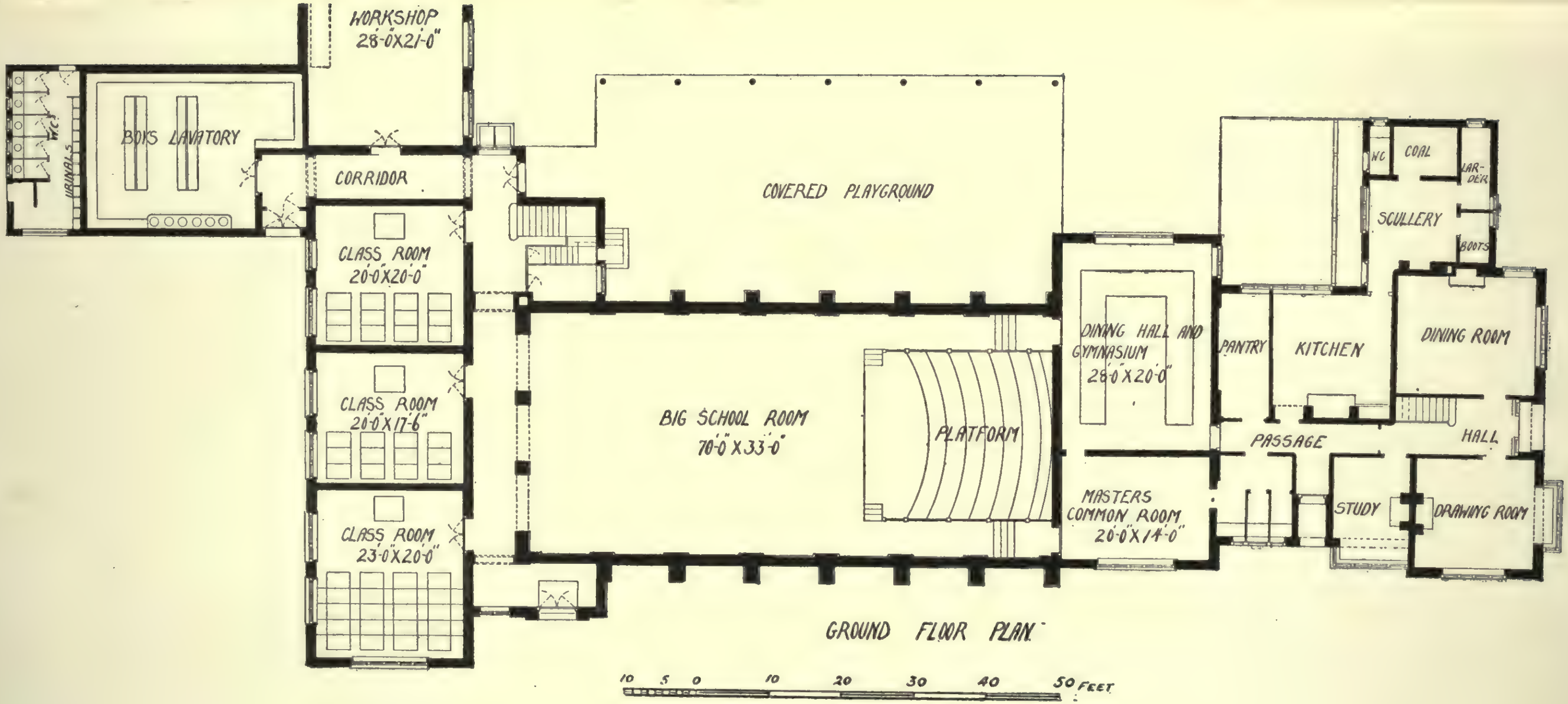


130 133. THE MANCHESTER HIGH SCHOOL.

Mills & Murgatroyd, Architects.



FIRST FLOOR PLAN

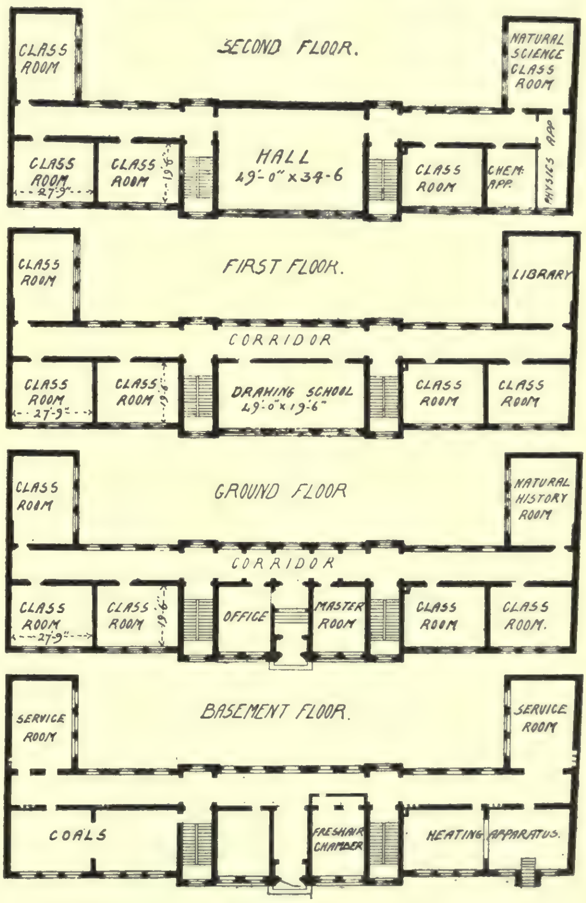


134, 135. THE JUDD COMMERCIAL SCHOOL, TUNBRIDGE WELLS.

W. Campbell Jones, Architect.

To face p. 198.

capacities from 36 to 50. The ground floor contains the servants' living-rooms, masters' rooms, library, and a large gymnasium which also serves for the purpose of a hall. The first floor is taken up with five class-rooms and a large studio. One of the class-rooms, having a preparation room for experiments attached, is used for a lecture-room for natural science. This leaves for school purposes six class-rooms, which is the minimum number for a Realschule, the course of instruction in which extends over six years. A larger school of the same kind is shown in Figs. 138-141, which gives the plans of the twelfth, the last and most recently erected of the Berlin Realschulen. The school is very simply planned, the necessary rooms opening off a long corridor. In this example there are sufficient class-rooms to enable any of the forms to be split up into parallel classes.



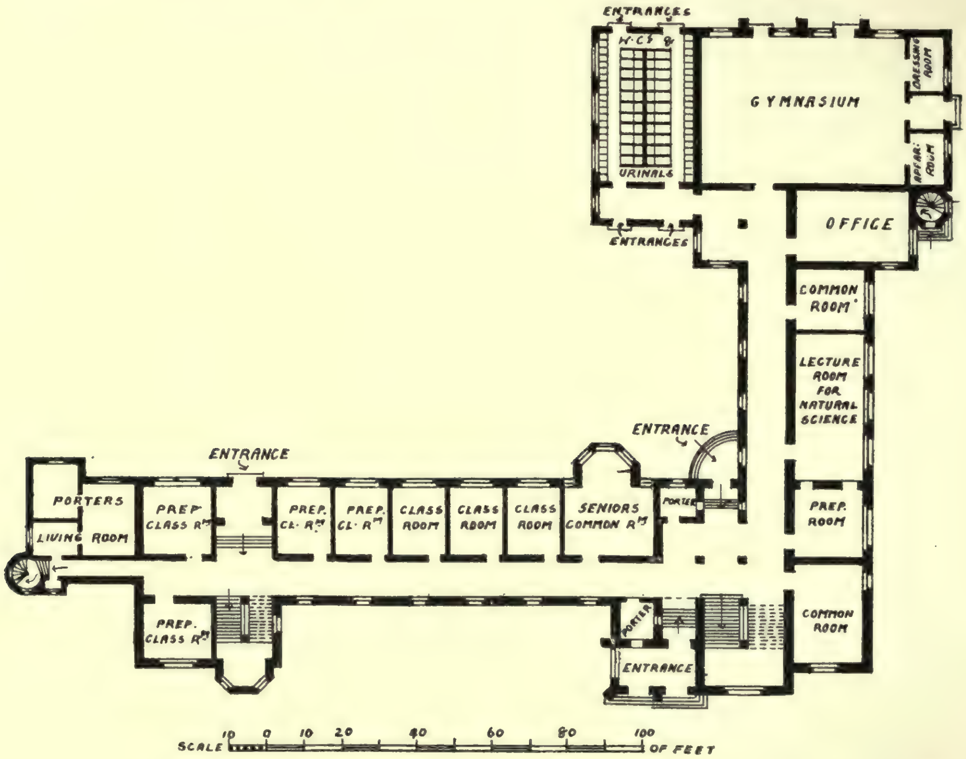
138-141. THE XII. REALSCHULE, BERLIN.

In the Gymnasia there are found a larger number of class-rooms due to the longer course. Fig. 142 gives the plan of a recently erected Gymnasium arranged on the principle of two corridors in the form of an L. The accommodation in this school, *Die Augustinerschule, Friedburg, Hesse,** is as follows:—Four class-rooms to hold 25 for the preparatory department, nine class-rooms for 25 for the gymnasial course, six rooms to hold 45 for the Realschule, and three reserve class-rooms. The other rooms comprise a large lecture-room, studio, singing school, museum, and library, conference and common rooms,

* From *Die Deutsche Bauzeitung*, 31st August 1901.

&c. The floor space allowed gives 10 sq. ft. for the younger pupils, and up to 15 for the older. The school has accommodation for 730 scholars.

The Kaiser Wilhelm's Gymnasium at Aachen (Figs. 143-145) shows another method of arrangement. The ground floor is taken up by three class-rooms for the preparatory school, conference and Head-master's rooms, school servants' living-rooms, and the gymnasium, the

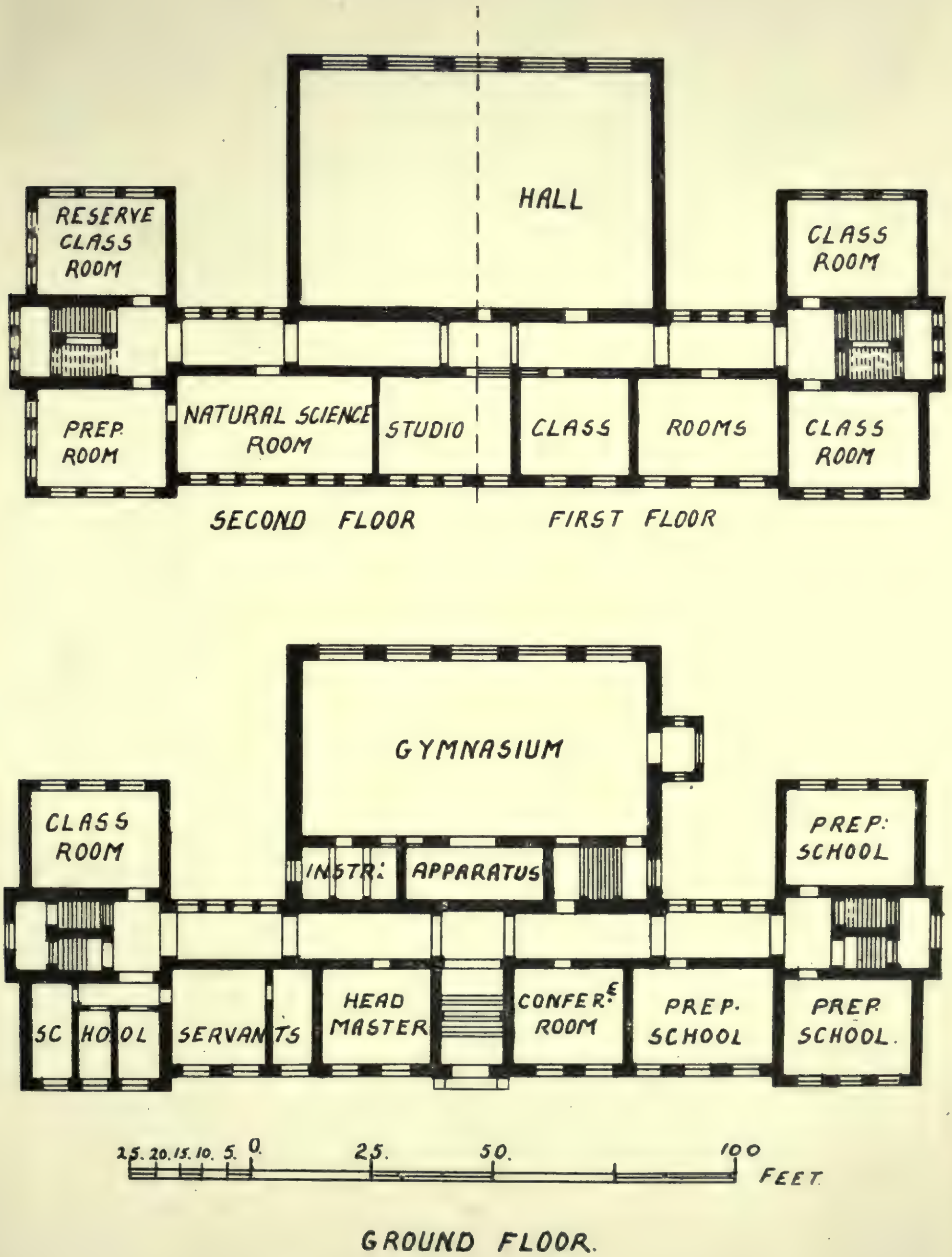


142. Die Augustinerschule (Gymnasium), Friedburg, Hesse.

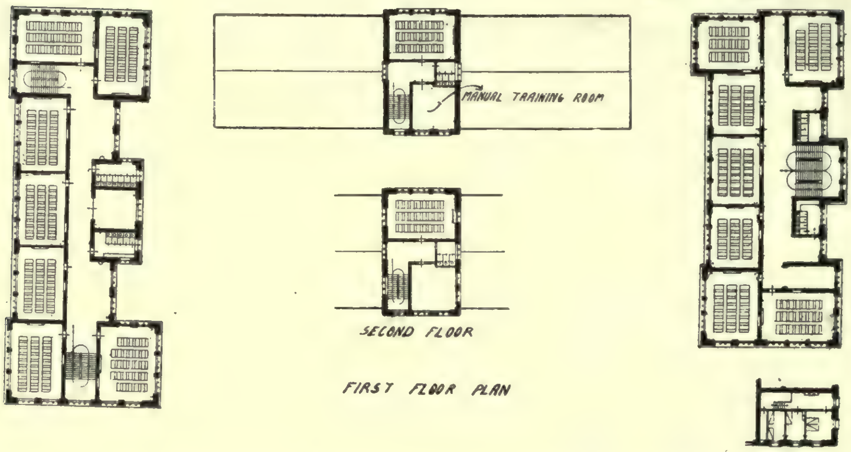
rooms for the gymnasial course being placed upon the first and second floor. The school is intended to take 600 pupils.

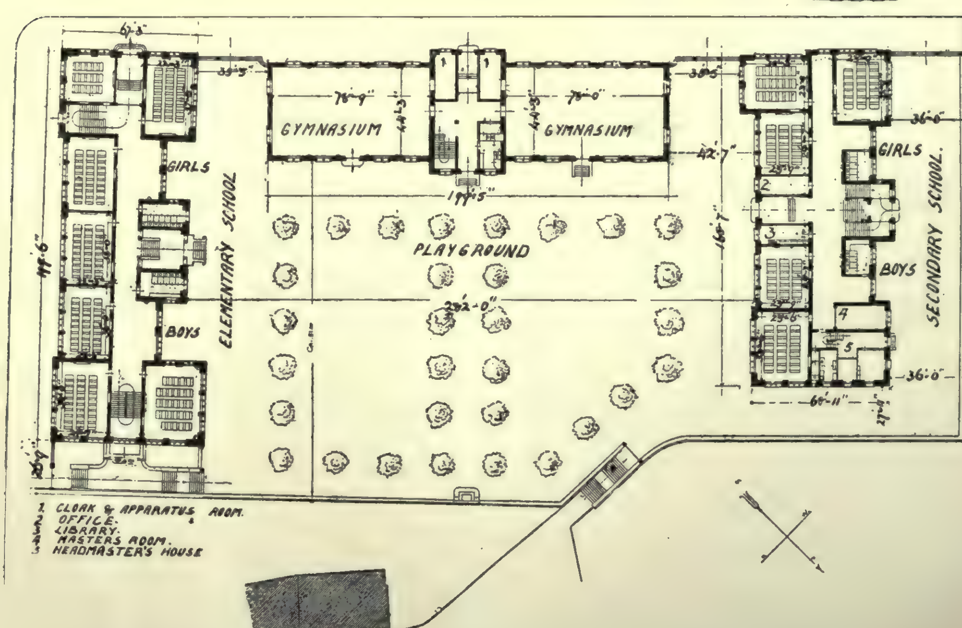
Figs. 146-148 show a combined scheme for an Elementary and Secondary School at Zürich * arranged in two blocks connected by two gymnasiums, between which are placed manual training rooms. A large playground planted with trees separates the two blocks of

* From Neuere Städtische Schulhäuser in Zurich, A. Geiser, 1901.



143-145. Kaiser Wilhelm's Gymnasium at Aachen.



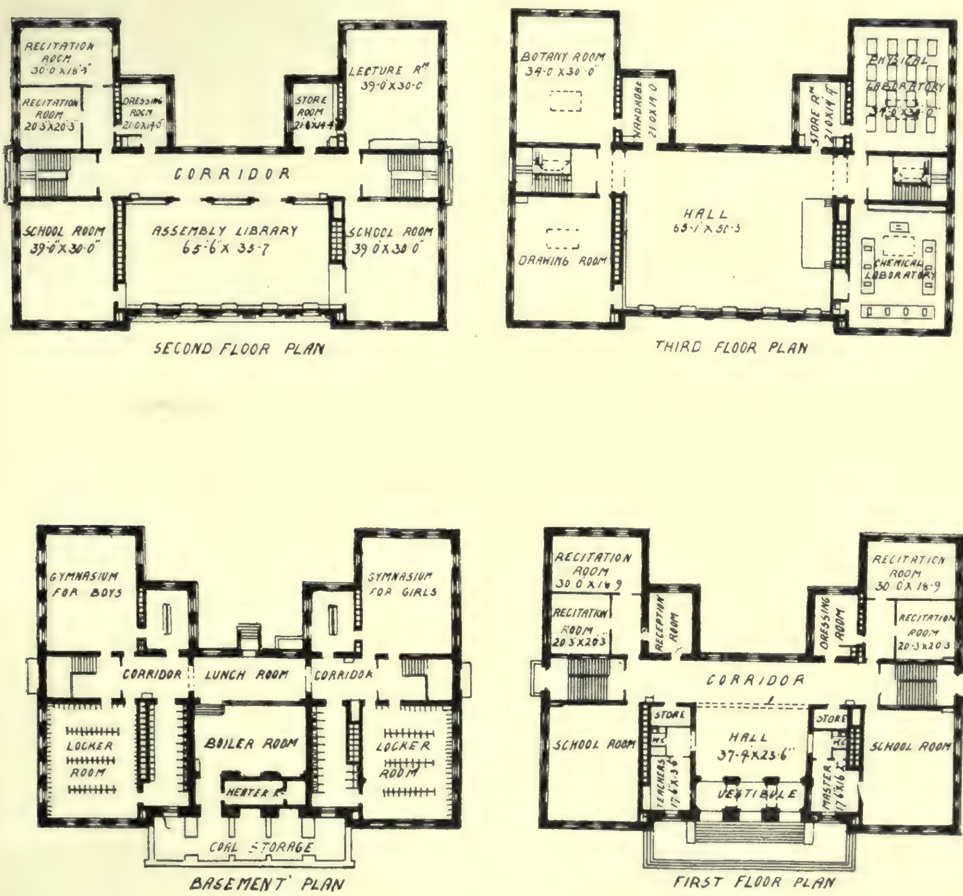


146-148. COMBINED ELEMENTARY AND SECONDARY SCHOOLS AT ZÜRICH.

A. Geiser, Architect.

buildings. A south-east aspect has been obtained for nearly all the class-rooms.

American Schools.—Figs. 149-152 show the arrangement of the *Brighton High School, Boston.* The basement is entirely occupied



149-152. THE BRIGHTON HIGH SCHOOL, BOSTON, U.S.A.

E. M. Wheelwright, Architect.

by the locker rooms and offices for the boys and girls, and a gymnasium for each. The first * and second floors show well the American system

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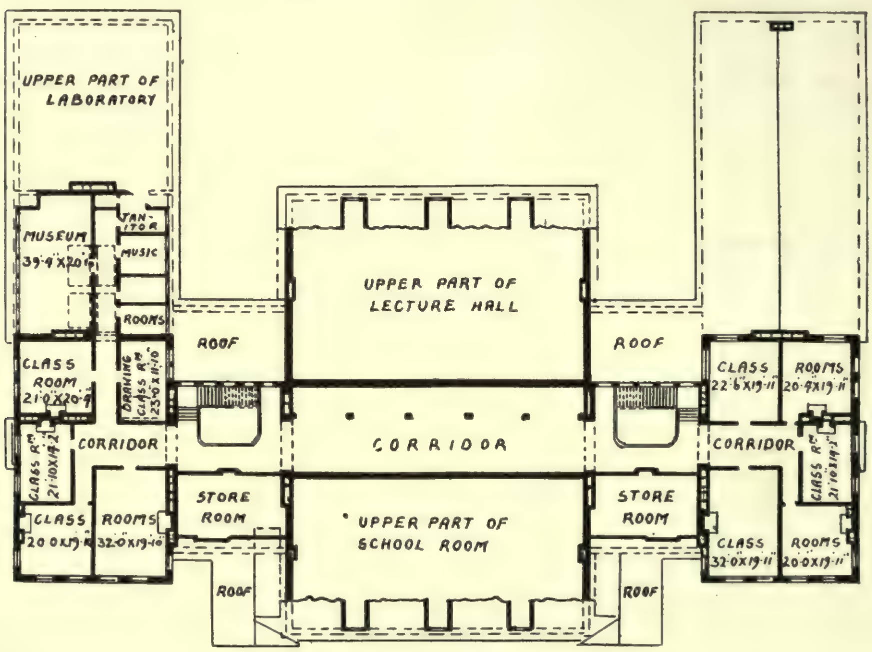
* Note the first floor is that which would in this country be called the ground floor.

of large school-rooms, with smaller rooms for the actual teaching, called recitation rooms. The top floor is devoted to science and art work.

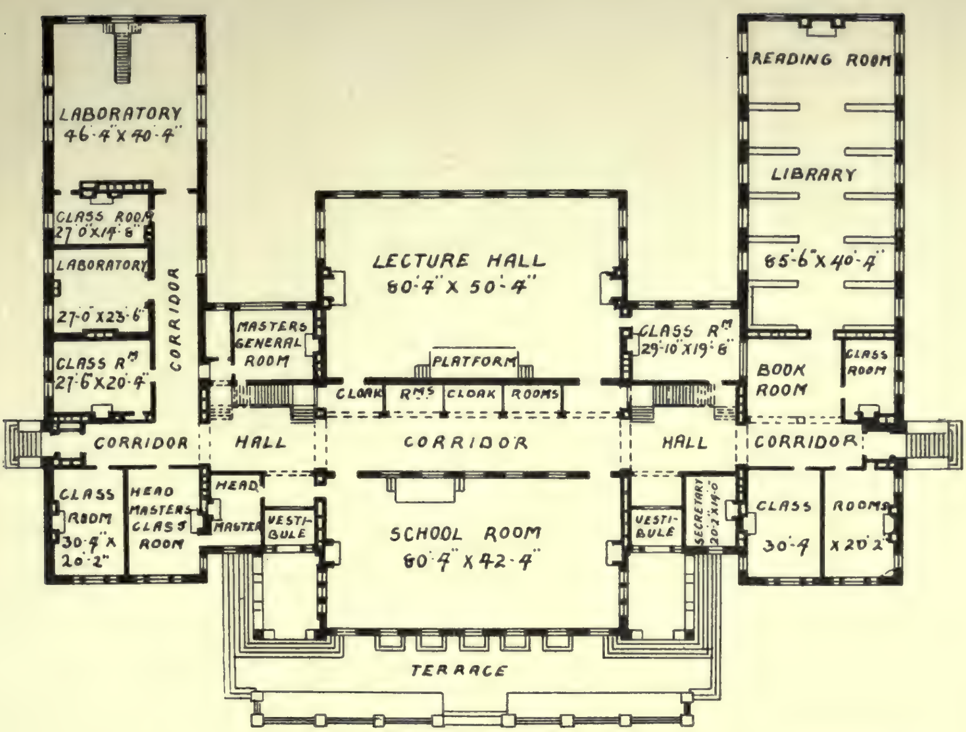
The Groton School (Figs. 153-155) shows an American Private School, giving a very full equipment of rooms planned on a lavish scale as regards room. The large school-room, measuring some 80 by 42 ft., has desk accommodation for 152 students. A small number of cloak-rooms are supplied in recesses taken off a wide corridor.



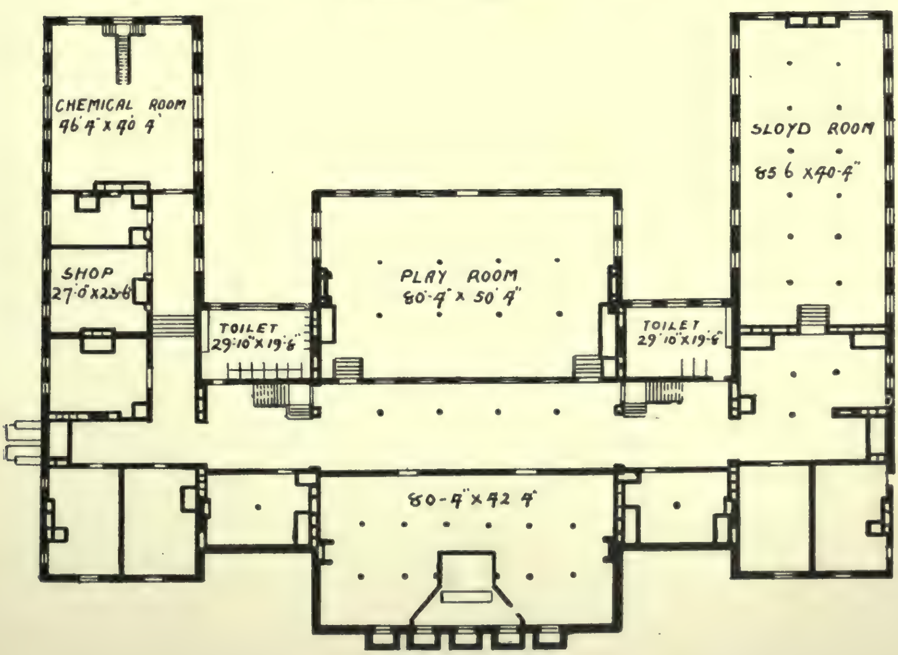
FIRST FLOOR PLAN

153. THE GROTON SCHOOL, U.S.A.

The organisation of American Schools is practically the same for the different grades, the Primary, Grammar, and High Schools all forming part of one course. This approximates more to our modern system of Board Schools than to that of the continually reclassified Secondary School of the present day, so that the comparison between American school buildings and those of this country has been discussed at greater length when dealing with the Elementary Schools of the two countries (see pages 348 *et seq.*).



GROUND PLAN



BASEMENT PLAN

154, 155. THE GROTON SCHOOL, U.S.A.

For further examples of Day Schools, see—

The figures in large type refer to volumes, the others to pages.

The Builder.—38, 600; 39, 262; 40, 340, 402; 41, 296; 43, 789, 283, 554; 45, 684; 49, 621; 50, 370, 672; 53, 345; 54, 433; 56, 318; 57, 64, 428; 58, 12; 59, 250; 61, 331; 64, 215, 448; 66, 464, 482; 67, 42; 68, 185, 331; 70, 471; 74, 319, 320, 419; 75, 316; 77, 40; 78, 266, 634.

The Building News.—38, 10, 190, 340, 598; 40, 202, 264, 328, 360; 43, 683; 44, 750; 48, 970; 50, 327, 782; 51, 1020; 52, 44, 474; 57, 658; 58, 306, 758; 61, 106, 511; 62, 369; 64, 799; 65, 69, 839; 66, 325; 69, 11, 557; 71, 663; 72, 129, 485, 559; 73, 149, 329, 718, 756; 75, 355, 375, 571; 80, 798.

The British Architect.—52, 6; 54, 273.

Girls' Schools.

The Builder.—38, 417, 451; 40, 773; 41, 388; 42, 578; 44, 810; 46, 606; 71, 140; 73, 328; 76, 92; 80, 491.

The Building News.—42, 760; 44, 788; 57, 178, 179, 484; 59, 356; 61, 462; 63, 753, 769; 64, 685; 71, 223; 74, 60; 79, 323; 81, 10.

CHAPTER XI.

TRAINING COLLEGES.

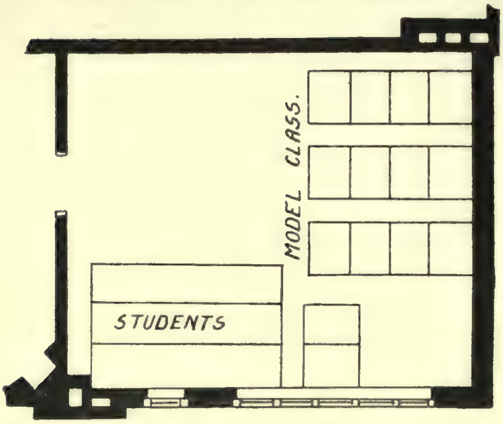
Training Colleges, Description of—Model Schools—Accommodation required—Class-rooms for Criticism Lessons—The Maria Grey Training College—Pupil Teachers' Schools—Offord Road School—The Froebel Training Institute, Kensington—German Training Colleges, Features of—List of Accommodation provided—The Training College at Pyritz—American Training Colleges, and Description—Example—School at Salem, Massachusetts.

WHILE Training Colleges might seem to be outside the scope of a book purporting to deal with schools, yet in many ways they partake so much of the character of a school, and in most cases have schools attached, that it has been thought as well to give a brief account of their plan and organisation. The main feature of a Training College is the combination, as it were, of two schools; there is the accommodation necessary to the students to be provided, and in addition that for the children of the Model or Practising School. The student teachers are themselves undergoing instruction in subjects of the nature of general culture, in addition to the actual study and practice of education, so that well-equipped laboratories for chemistry, physics, and botany must find a place besides the studio, manual training rooms, class-rooms, and lecture rooms of the ordinary type found in Secondary Schools. As a rule Training Colleges are entirely or to a large extent residential, so that very often boarding arrangements must be included. In some cases no provision is made for a Model School, the actual practice in teaching being gained from schools in the neighbourhood. In other cases accommodation for students is added to an already existing school, and so to form a Training Department.

The accommodation, in addition to the residential part of the building, includes separate cloak-rooms, lavatories, &c., for the students and for the pupils of the Model School; a large class-room for criticism lessons; and there will be of course as many class-rooms as may be necessary for the Model School. If there are women teachers in training,

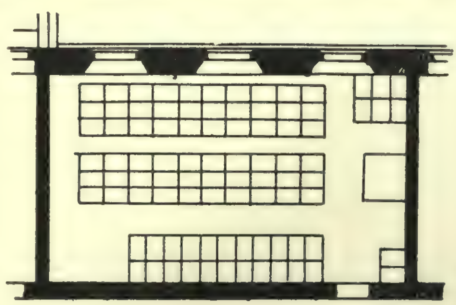
a Kindergarten room, &c., will be necessary. The rest of the building, containing the rooms for the instruction and use of the students, will be much like that of a good Secondary School, with perhaps rather more attention paid to the rooms for natural science teaching, and the library.

Class-rooms for Criticism Lessons.—In schools or colleges for training teachers it is necessary to have at least one room arranged for the purpose of criticism lessons. This is arranged with two blocks of desks, at one of which sit the students, *i.e.*, teachers in training, at the other the model class which is to receive the lesson. One of the student teachers, already selected, has to give a lesson to this class, which lesson has of course been previously prepared. At the end of the lesson the model class is dismissed and various students are called upon to criticise the lesson just given. The master then sums up, criticising both the lesson given and the criticisms made. What is required for this purpose is, firstly, that every one, both the class taught and the students looking on, should be able to see the blackboard clearly.

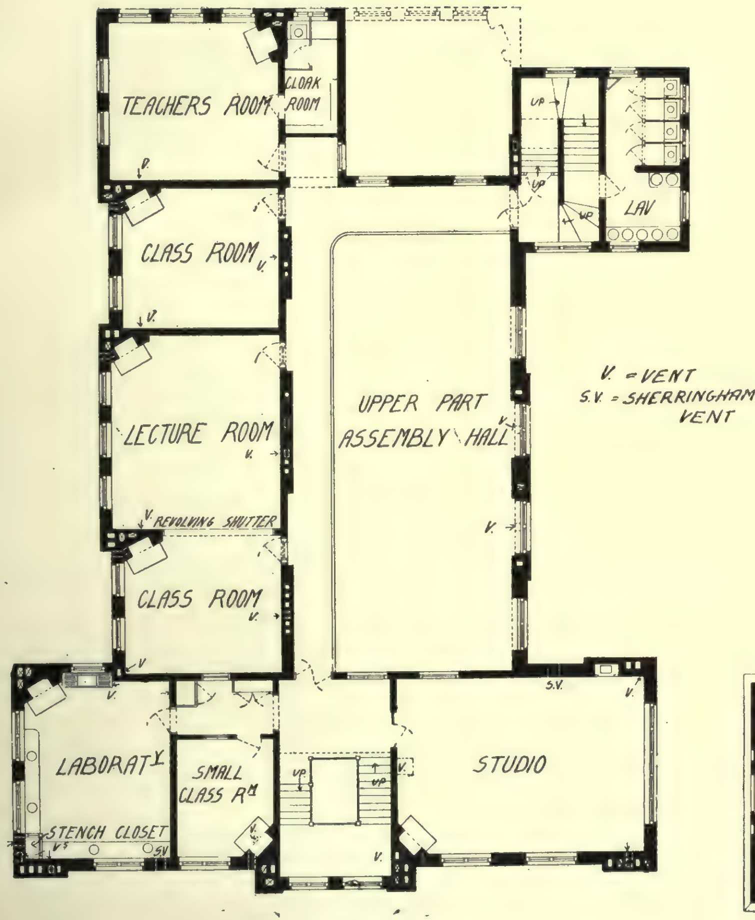


156. A "CRITICISM" CLASS-ROOM.
From a School by J. Osborne Smith.

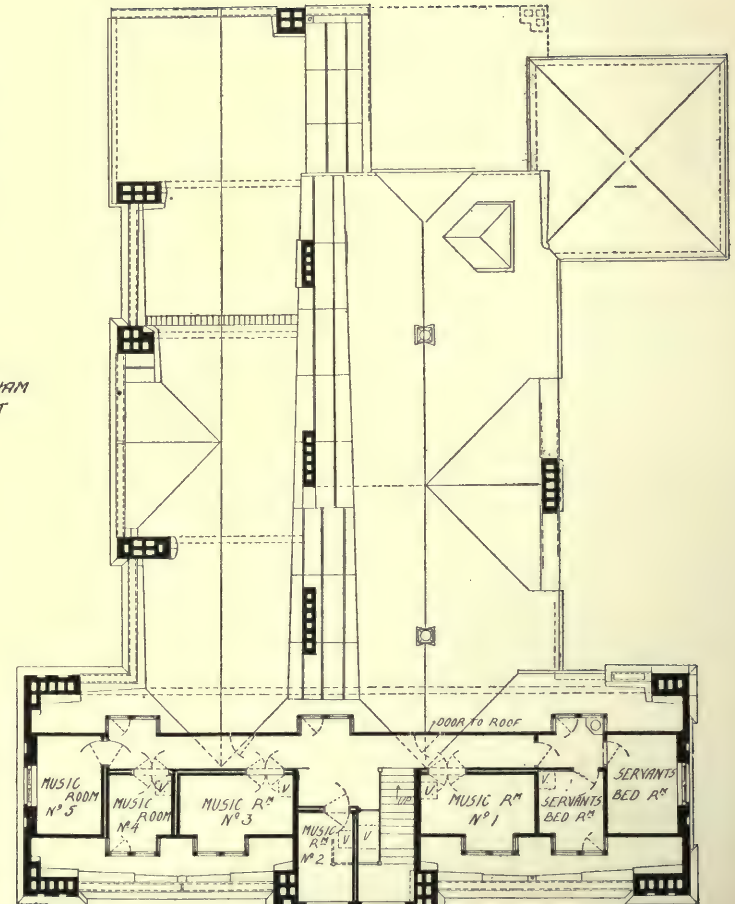
The students should all be able to have a good view of the class taught, to be able to see how far they are following the lesson, and naturally the master must be able to see everything well. A class-room arranged for the purpose of a criticism lesson is shown in Fig. 156. It is quite admissible in such a room to admit light from the back of the students, as the fact of their sitting in their own light is not of any importance. They have not to read nor to write, except perhaps for the purpose of making a few notes, and the light coming from behind them lights the class and blackboard well. It is sometimes thought desirable that the students watching the lesson should



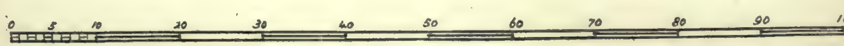
157. A CLASS-ROOM FROM A GERMAN TRAINING SCHOOL.

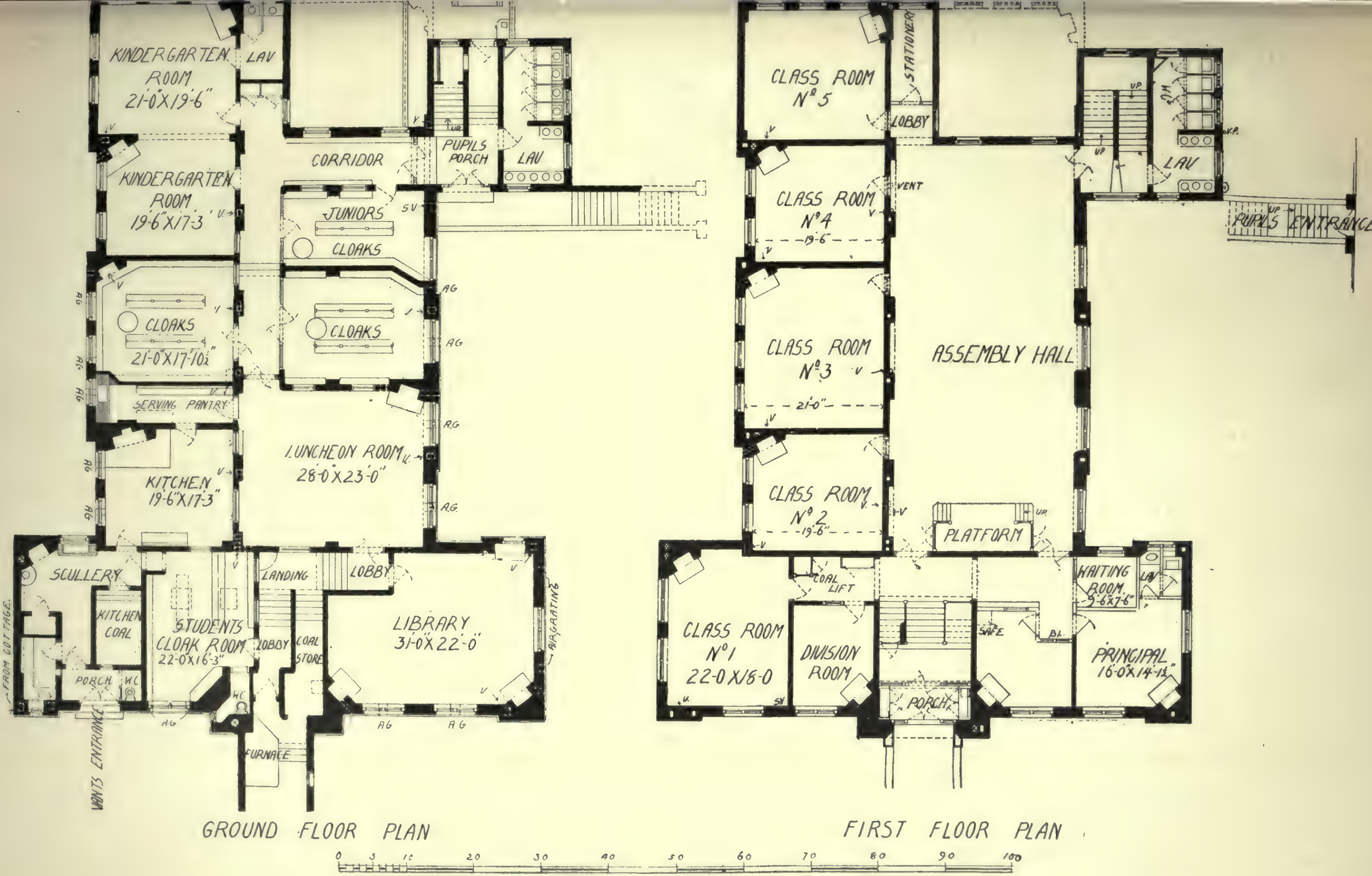


SECOND FLOOR PLAN



PLAN OF ROOF AND MUSIC ROOMS





158-160A. THE MARIA GREY TRAINING COLLEGE.

Between pp. 208 *and* 209.

J. Osborne Smith, Architect.

not be placed too much in view of the class; this can be managed when the number of students is small. Fig. 157 shows a class-room from a German Training School.

In Figs. 158-161 is shown as an example *The Maria Grey Training College*. This is for the instruction of women teachers. There is accommodation in this building for about fifty students and the Model School. It is a Day School, but a hostel for residence in connection with it has recently been opened. The work in the school is divided into three departments—higher, lower, and Kindergarten.

161. THE MARIA GREY TRAINING COLLEGE.

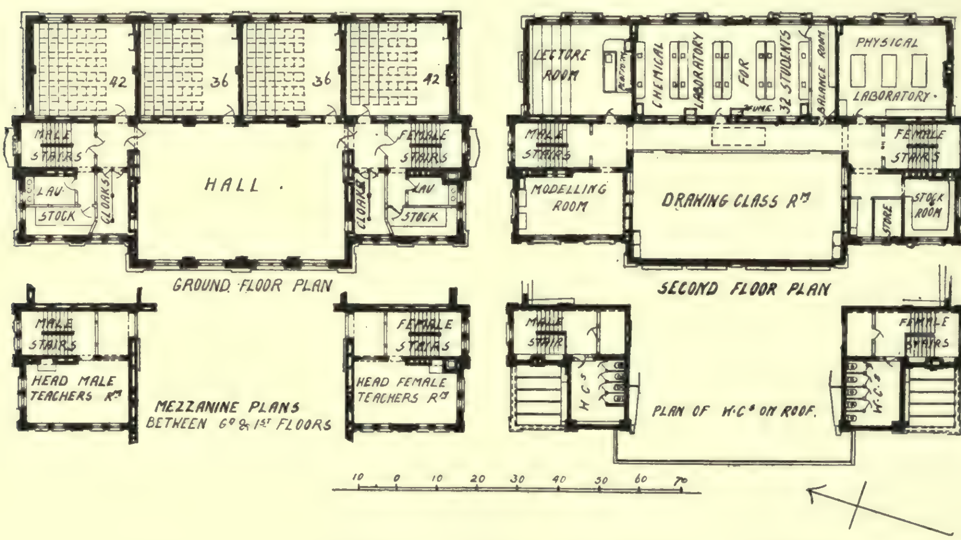
J. Osborne Smith, Architect.

The plan provides separate entrances for pupils of the Model School and for the students, with separate cloak-room accommodation, which, with the dining-room, library, and kitchen, takes up the basement. On the first floor and other floors are found the class-rooms and the assembly hall. At the top are placed the chemical laboratory, studio, and music-room.

The Froebel Training Institute, West Kensington (Fig. 162). This consists of a college for the students connected with the school and Kindergarten by means of a covered garden, each part being com-

plete in itself. The school is arranged with a hall and eight class-rooms, one of which, of considerable size, is divisible by a partition. This serves for the Kindergarten room, and being just opposite the hall, the children can easily go there for their marching games and exercises.

Pupil Teachers' Schools.—The London School Board have established in various parts certain centres, at which the pupil teachers * practising in the various Elementary Schools attend, in order to receive instruction themselves. Formerly the pupil teachers were taught at certain hours by the head teachers of the school in which they were. It has been found, however, more satisfactory to have special schools



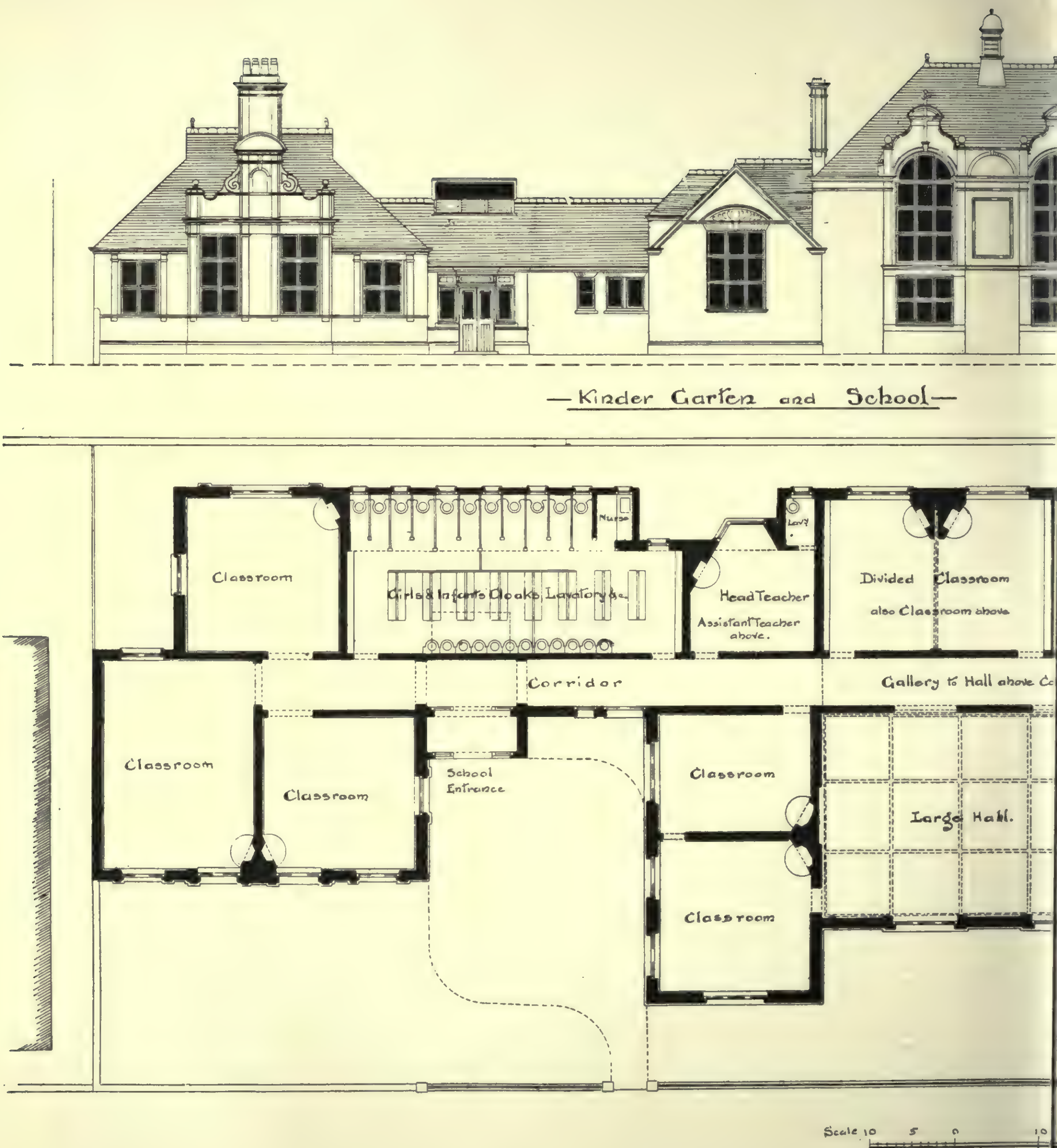
163, 164. Pupil Teachers' Centre, Offord Road, Finsbury.

The London School Board. *T. J. Bailey, Architect.*

in which they can be efficiently taught. These schools do not offer any unusual features in their plans or general arrangement, since there is no practice in the art of teaching at the centres, the students being engaged for part of their time every day in school. The form in which these pupil teachers' centres are arranged is practically that of a Secondary Day School on the central hall system.

Figs. 163 and 164 show *The Pupil Teachers' Centre at Offord Road, Finsbury.* On the ground and first floor are each four class-rooms, making together a total accommodation of 320. On the second floor are a

* For pupil teachers see page 299.



162. THE FROEBEL

STITUTE, WEST KENSINGTON.

J. S. Quilter, Architect.

Between pp. 210 *and* 211.

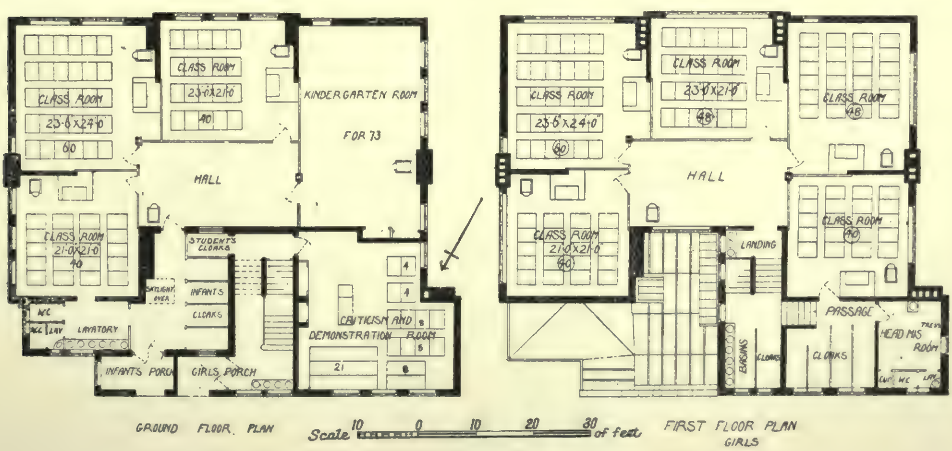
large chemical laboratory, drawing class room and modelling room, a physical laboratory and lecture room. Each sex has a separate stair-

165. PRACTISING SCHOOL, SAFFRON WALDEN.

The British and Foreign School Society. *J. Osborne Smith, Architect.*

case arranged at either end of the building. The sanitary conveniences are placed on the roof.

Practising School, Saffron Walden.—Figs. 166 and 167 show the

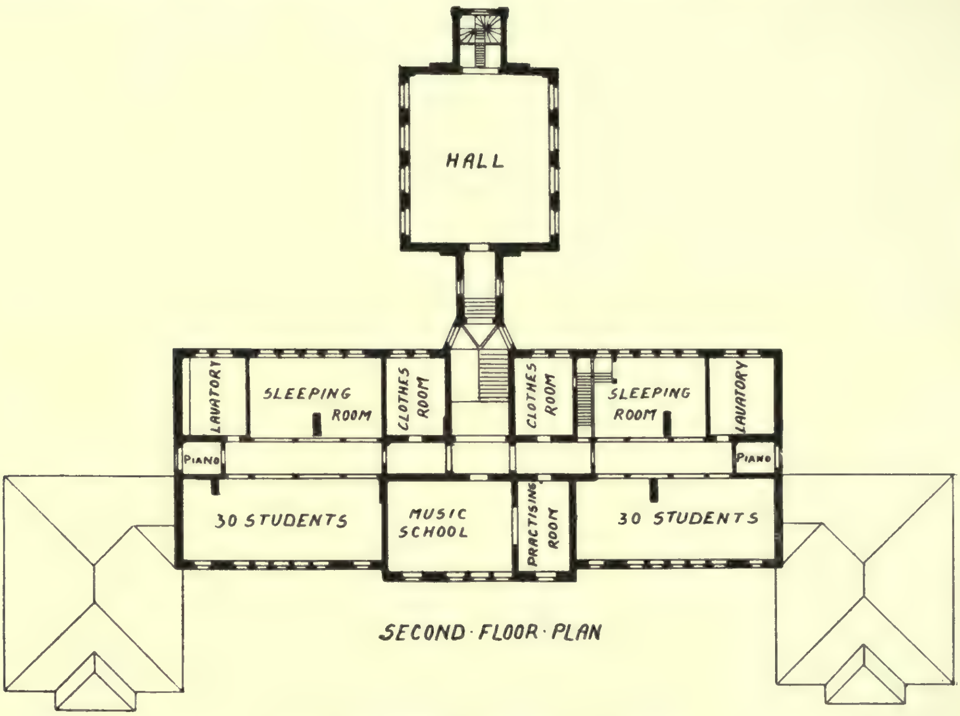


166, 167. PRACTISING SCHOOL, SAFFRON WALDEN.

arrangement of a Practising School attached to a Training College at Saffron Walden. On the ground floor is accommodation for 220

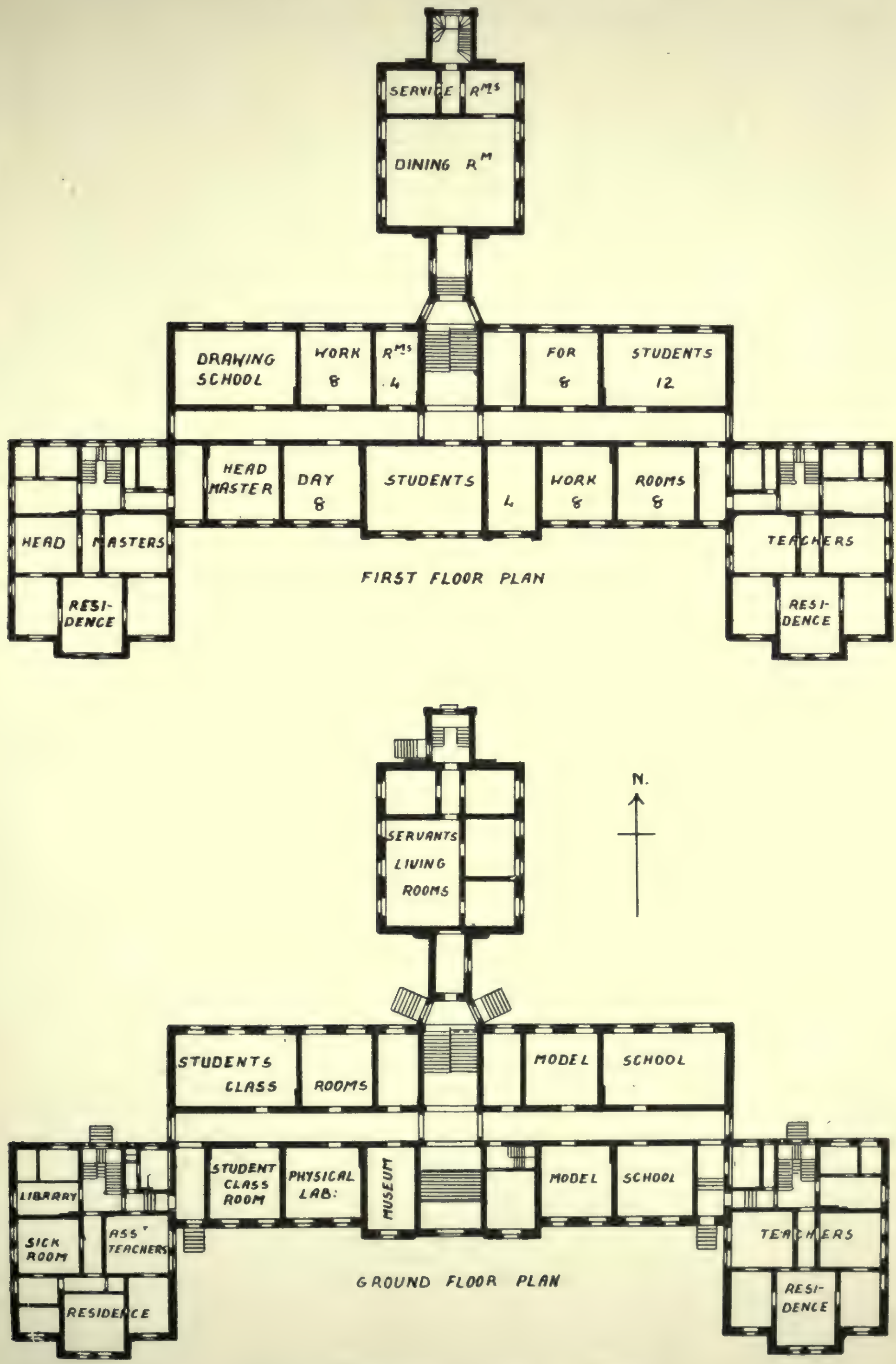
infants, arranged in four class-rooms separated from a central hall by movable glass partitions ; these rooms are so arranged that when these partitions are in their places, the mistress in the centre can see what is going on in each room ; when they are folded back, the whole floor becomes practically a large floor. A similar arrangement on the first floor takes 228 girls. A view of the exterior is shown in Fig. 165.

German Training Colleges.—Training Colleges in Germany occupy a far more important part in the educational system, especially



168. Training College at Pyritz.

with regard to teachers for Secondary Schools, than in this country, so that it may be of value to give a brief account of their arrangement. In most respects they are organised in much the same way as those in this country, combining a College where the students receive instruction in the theory and practice of teaching with a Practising School in which they can put into actual practice what they have learnt, and also themselves continue to work at subjects of general culture. Although most of these institutions are similar in their general organisation and studies pursued, there is a wide difference in the time given to the course, which varies from a two to a six years' course in different



169, 170. Training College at Pyritz.

institutions, and again in the actual arrangement of study. As the office of teacher is often closely connected with the Church, so music teaching, especially the use of the organ, plays an important part. In recent times a good deal of time has been given to gymnastic training.

The Training Colleges are either residential, or Day Schools, the students living in the neighbourhood, or more often a combination of the two. In Würtemberg, Baden, &c., residential Training Colleges are the more usual. In Prussia, Saxony, and other States it is common to find the combination of day and boarding establishments.

The Training Schools (Seminarschulen), in which the pupils learn both the theory and practice of education, have in most states, Saxony, Würtemberg, Prussia, &c., a three years' course, in Bavaria only two. The number of students in training is on an average from 75 to 100, so that the classes to have a three years' course would vary from 25 to 30, or for collective purposes 50 to 60. Where the numbers are greater, the classes would be split into parallel forms. The Practising or Model Department generally consists of a school of four classes. In addition to this there is attached to many of these institutes a Preparatory School or Proseminar which prepares younger scholars for entry into the Training College. This may be either a separate institute, or be included in the same building as the Seminar. These Preparatory Schools have as a rule three, sometimes four classes. If required by the condition of the neighbourhood in which it is placed, more classes would be added.

The following list gives the rooms that are usually provided*:—

For the school part of the building:—

- For the students' training, the class-rooms necessary according to the number of students and length of the course.
- Studio.
- Chemical and physical laboratories.
- Library.
- One or more rooms for special collective purposes.
- Rooms for music-teaching.
- Hall (containing the organ if there is one).
- For men students, a manual training room.
- Women students, a room for domestic economy training.
- Director's room.
- Teachers' common room.
- Cloak-rooms, lavatories, &c., and recreation room for the students.
- Sometimes a guest room for visitors and inspectors is added.
- For the Practising School, the necessary number of class-rooms (usually four), cloak-rooms, lavatories, &c.
- And common to the Training School and Practising School, rooms for the teaching and practice of gymnastics.

* Handbuch der Architektur.

Gardens and playgrounds.
In the case of residential colleges :—
- Living or work room.
- Sleeping rooms, lavatories, bathrooms, and clothes room.
- Sick rooms, reception rooms, rooms for linen.
- Dining-rooms, kitchens, &c.
- Stores, &c., for the boxes and property of the students.
- Director's private living room, and the necessary accommodation for servants, yards and gardens. This part does not materially differ from the requirements of an ordinary Boarding School.

A good example is the Training College at Pyritz,* given in Figs. 168-170. This building is intended to accommodate 60 residential and 30 day students. The centre block of the building is arranged for school purposes, the living rooms of the Director and the assistant teachers being the two wings, while in the projecting wing at the back is arranged the kitchen, with the dining-room immediately over. The Practising School consists of the usual four class-rooms on the ground floor, where are also the students' class-rooms and the physical laboratory. The first floor, except for the studio, is taken up by the students' day-rooms or work-rooms, while on the top floor are the dormitories and music-rooms.

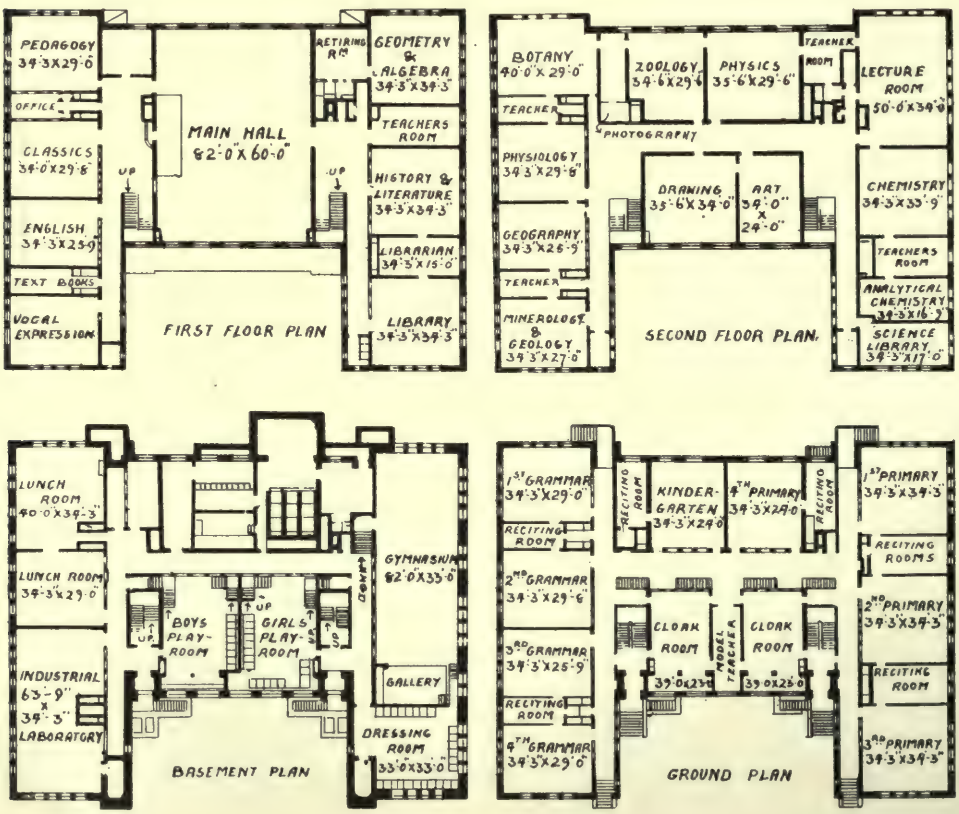
American Training Colleges.—In the United States the Training Colleges are called "Normal Schools," and are as a rule State institutions. The fully developed Normal School has class-rooms for Kindergarten, primary and grammar grades, with entrance and toilet rooms distinct from those for the students. For the latter there is an "assembly" or "study room" with single desks and chairs for a maximum of 250 students, and special rooms for instruction in geography, mineralogy, zoology, history, literature, pedagogy, and languages. There are also physical, botanical, and chemical laboratories, and rooms for instruction in drawing, music, and manual training. In addition a good-sized library and gymnasium are considered essential features. In Figs. 171-174 is shown the State Normal School at Salem, Mass., taken from Mr Wheelwright's "School Architecture." In the basement, besides the heating and ventilating apparatus, are the toilet and play rooms for the pupils of the Model or Practising School, a large gymnasium and dining-room, a lunch-room and store-room.

On the ground floor are toilet and cloak rooms provided with individual lockers for the students of the Normal School, for whom there are two outside entrances. In each wing are the entrances to the Model School, for which nine class-rooms are provided entirely

* Handbuch der Architektur, Band IV.

distinct from the Normal School. On the first floor is the assembly hall, 60 by 85 ft., with the principal office, reception room, teachers' meeting room, with toilet room, library, supply, recitation, and work rooms.

The second floor is chiefly given up to science instruction, and besides the special rooms devoted to the various subjects, there is a lecture-room with the seats arranged in tiers. There are also two rooms for drawing on the north side. The school, as is almost always the case in American Schools, is a Day School. The Model School is sometimes found in a separate building. Sometimes a neighbouring school is utilised for the purpose of practice. The American Normal Schools and Training Colleges are built usually on a very liberal scale, and are very fully-equipped and well-arranged buildings.



171-174. State Normal School, Salem, U.S.A.

J. P. Rinn, Architect.

CHAPTER XII.

BOARDING SCHOOLS.

Two Classes of Boarding Schools—Preparatory Schools—Questions arising in Boarding Schools—List of the Accommodation of a Large Boarding School—Schools with separate Boarding Houses—Different Ways of dealing with the General Scheme—Quadrangles or Separate Blocks of Building—Objection to the Quadrangular System—The New Buildings for Christ's Hospital, Horsham—Comparative Survey of three of the Designs in the Competition—The Royal Masonic Institution for Boys, Bushey, illustrated and described—School Blocks in a Large School—Kitchens and Offices.

Boarding Schools fall practically into two classes. In the first are the schools arranged with a central block, containing what are generally called the school buildings, with a number of boarding houses grouped round, in which the pupils live. In this form are found most of the old Public Schools. In the second are found the schools which are complete in themselves, containing in one block not only the living-rooms for the pupils, but the necessary rooms for educational purposes as well. They are of course smaller schools. Boarding Schools for girls have, with one or two exceptions, been up to the present arranged on this plan, and usually the Preparatory Schools, of which there are such a large number, and which play so large a part in secondary education in this country. These Preparatory Schools are in most cases separate from and entirely independent of the larger schools for which their pupils are being prepared, and to which they will ultimately go. They are usually Private Schools, owned and managed by the Headmaster, and do not keep their boys beyond the age of fourteen or fifteen. These schools are not only peculiar to this country, but of comparatively recent growth. In the introduction to the sixth volume * of the Special Reports issued by the Board

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* Preparatory Schools, vol. vi.

of Education, it is stated that the first true Preparatory School was probably that founded by Lieutenant Malden in 1837. The large increase in the number of these schools in recent years and the keen competition has resulted in the building of very fully and efficiently equipped schools, and since their success is usually judged by the number of pupils who win scholarships at the Public Schools, the teaching has to be kept up to a high standard, but with a strong tendency to cramming and specialisation. Some of the large Secondary Schools have Preparatory Schools attached to them, the boys of the two schools being kept separate. In these cases the boys at the Preparatory Schools get the advantage of the use at certain times of the school gymnasium, swimming baths, &c., which cannot always be supplied by the ordinary Private School, though it is remarkable how very completely some Private Schools are provided with expensive additions of this kind.

The central block of a large Boarding School offers naturally much the same problems in regard to planning as that of a large Day School—that is as far as the educational requirements are considered. It often happens, of course, that a school begins as a Day School, and eventually, by the growth of residential accommodation in connection with it, becomes a Boarding School. In other cases a small Boarding School becomes the nucleus of a large one and remaining as the central block of the school, is still distinguished by some particular name, such as the School House. In the case of the rebuilding of a large school on a new site, as for example the recent moving of Christ's Hospital School from London to Horsham, it becomes possible to treat the whole scheme systematically instead of the somewhat haphazard way in which our older schools have grown up. Various arrangements providing for the more economical working of the school then become possible, such as the provision of a central dining-hall and kitchen for the whole school, the supply of heating for all the buildings from one centre, &c. The arrangements of the large Boarding Schools in this country and the accommodation they provide show so great a variety in so many different forms that it is an almost impossible task to find any points where they can in any way be divided into classes. There are schools to suit every rank of social life, with fees varying from an inclusive charge of £30 or £40 a year up to £150 or £200.

SCHOOLS WITH SEPARATE BOARDING HOUSES.

Accommodation.—The question of the extent of the accommodation that has to be provided is not an easy one to deal with, owing to the variety of the different kinds of schools. On the whole it has been considered that the best plan would be to give a list as full as possible of the different rooms and buildings that a large first-class Boarding School of the present day is supposed to have. The following list, though not pretending to be exhaustive, will be found to contain most of the rooms that are usually provided. The rooms that belong strictly to the educational block have been discussed previously in dealing with Day Schools, and are only alluded to here in regard to their position in the general scheme of the school.

List of requirements of a large Secondary Boarding School :—

Central Block and Administrative.

Entrance hall with porter's lodge.
Reception-room.
Board or Committee room.
Headmaster's room.
Secretary's office and clerks' office.
Assistant masters' common rooms.
Luncheon-rooms for Committee and serving-rooms.
Lavatory accommodation for each of the above.
Large dining-hall.*
Serving-rooms.
Assistant masters' dining-room, pantry, &c.
Kitchens.
Sculleries, vegetable sculleries.
Pantries.
Dining-hall for men servants.
Dining-hall for women servants.
Larders.
Store-rooms for groceries, table linen in use, china, glass, &c.
Cellars.
Servants' lavatories and W.C.'s.
Cook's sitting-room.
Storekeeper's office.
Head Matron's sitting-room, bedroom, &c.
Assistant Matron's sitting-room, bedroom, &c.
Dormitories for the school servants, box-rooms, &c.
Central store for linen.
Airing-room and soiled linen room, &c.

Educational.

Large school hall with platform, &c.
Class-rooms of different sizes.†
Headmaster's class-room.
Sixth form room.
Studio for drawing.
Studio for modelling.
Studio for mechanical drawing.
Library and reading rooms.
Museum.

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* This is of course for schools where meals are not taken in the boarding houses.

† For numbers and sizes see pages 86 *et seq.*

Natural Science.

Chemical laboratory and store-room.
Physical laboratory and store-room.
Balance-room.
Dark room for optical work.
Dark room for photographic work.
Botany and Biology and microscope room.
Natural History.
Machinery room, testing instruments, &c.
Lecture-room for Chemistry and preparation room.
Lecture-room for Physics and preparation room.

Music School.

Music hall.
Music-rooms for pianos, singing, teaching, &c.
Music-rooms for band.
Music practising rooms.*

Separate Buildings.

Chapel.
Gymnasium.
Sanatorium.
Infirmary.
Swimming bath.
Headmaster's private house.
Assistant masters' houses for those not in control of boarding houses.
Armoury for rifle corps.
Covered drill sheds.
Carpenter's shop, smith's forge, rooms for bookbinding, printing, turning, &c.
Steam laundry.
School block of W.C.'s, urinals, &c.
Pavilions for cricket and football grounds.
Fives courts, tennis courts, racquet and squash racquet courts, &c.

Boarding Houses.

Dormitories or cubicles.
Prefects or monitors' cubicles in dormitories.
Day-room, sometimes an additional one of smaller size, for some of the older boys.
Studies.
Sitting-rooms and bedrooms for assistant masters as required.
Box-room, linen and clothes room.
Locker room with locker for every boy.
Boys' boot-room, airing-room, and drying-room.
Furnace-rooms, boot-cleaning, coal, wood, &c.
Room for games clothes.
Ward and store room for linen.
Night W.C.'s, and bath-rooms near dormitories.
Lavatory with wash-hand basin for each pupil.
If there is no central dining arrangement, a dining-room and necessary kitchen arrangements must be found in each house.
Matron's room, store-rooms, &c.
Sick-rooms.
Servants' rooms.

The above list will give some idea of the great number and variety of rooms that go to make up the modern large school.

The problem of how to combine all these rooms and buildings so as to form a school can be approached in two ways. Either a reproduction can be made in some form, modified to suit modern requirements,

* In Girls' Schools it is usual to provide a much larger number of music-rooms than is necessary for a boys' school.

of the old quadrangular arrangement, on the lines of the old colleges and other mediæval seats of learning, with an entrance gateway, the hall, chapel, and other rooms grouped round one or two quadrangles; or on the other hand the school may be more or less broken up into separate blocks. At first sight the former plan seems much the more attractive. It offers splendid opportunities for architectural effect; it has all the force of tradition behind it; and there is also little doubt that it offers the easiest solution of the best way to secure a compact plan, a school that shall be easy to supervise and economical in working. In spite, however, of the many and great advantages of such a method of planning a large school, it has in recent years met with less favour, the reasons against it being based on the questions of health. There is, it is argued, in such an arrangement bound to be a considerable portion where the air is to a large degree stagnant, and upon which the sun cannot have fair play. Where the quadrangle is of great size, as in the case of a large school, and the buildings not very high, this objection would probably not be a very strong one; but at the same time, where buildings are arranged more or less symmetrically on the sides of a square, it is hardly possible to provide a suitable aspect for all the rooms. Another point in this connection should be noted, that while the quadrangular arrangement is perhaps suitable for the purpose of a college where there have to be a great number of staircases with small sets consisting of two or three rooms, it is not as well adapted for a school where boys are housed in blocks of 50 or 100. This point has been shown well in the recent competition for the new buildings for Christ's Hospital, recently completed at Horsham, in which case the winning design, that sent in by Messrs Aston Webb & Ingress Bell, is arranged on the system of separating the residential portion into separate blocks, while the school (or educational) buildings are combined into one quadrangular block. This particular scheme, whether considered from the point of view of health and sanitary science or from that of the easy and economical working of the school, has met the difficulty of providing for the large numbers most successfully. It is interesting to compare with it the competition design of Messrs Carpenter & Ingelow, illustrated in Fig. 177, who have planned their building on the quadrangular method, in which style of school planning they have had much experience. Their plan too serves as an excellent example of what can be done in that method of planning a school. A third design, in which the buildings are arranged in an irregular group, is also illustrated, the design submitted by Messrs Paley & Austin. These three

plans have been illustrated together in Figs. 176-178 in order to show comparatively three different methods of dealing with a similar problem, in each one of which the scheme is treated from an entirely different point of view. The new schools at Horsham for Christ's Hospital are, I suppose, the largest school buildings that have been built in this country all at one time, so that the question could be treated as a whole and the entire scheme put in working order at once. The problem set before the five firms of architects who had been asked to compete was no easy one. There were to be boarding houses to take 700 boys in addition to the Preparatory School, each house to be so arranged that no dormitory or day-room should have more than 25 boys in it. All the dining arrangements were to be in the central hall. No meals of any kind were to be provided in the houses, either for boys, servants, or masters. In the educational part the class-rooms were to be in connection with the school hall, which was to be sufficiently large to take the whole school. The Preparatory School was to be kept separate from the rest of the school, but so arranged that the boys in it could make use of the central dining hall. There were of course to be also included—Science and music schools, a gymnasium, chapel, &c.

The block plans of the three designs are shown opposite. The lowest one, Fig. 178, that of Messrs Aston Webb & Ingress Bell, shows the building as it is now built. A better idea of it will be gained from the bird's-eye view, Fig. 175. This plan offers a very ingenious and satisfactory solution of the question. The underlying idea of the scheme was to divide the school into two sections—that is, the residential portion and the working portion. In this way, by treating the educational or working buildings as one block, arranged on the quadrangular system, it is possible to so group the buildings that they shall be compact, easily supervised, and economically worked. By breaking up the residential block it has been possible to secure not only a free circulation of air, but a position for every boarding house in the aspect considered most desirable. The block plan and bird's-eye view together show very clearly the connection between the boarding houses and the rest of the school. The residential blocks run east and west from the large block of buildings containing the great dining-hall and kitchens, the whole line curving slightly backwards. One of the houses is illustrated and described below.* Underneath all the school buildings, cloisters, and boarding houses runs a subterranean passage sufficiently large to admit of a

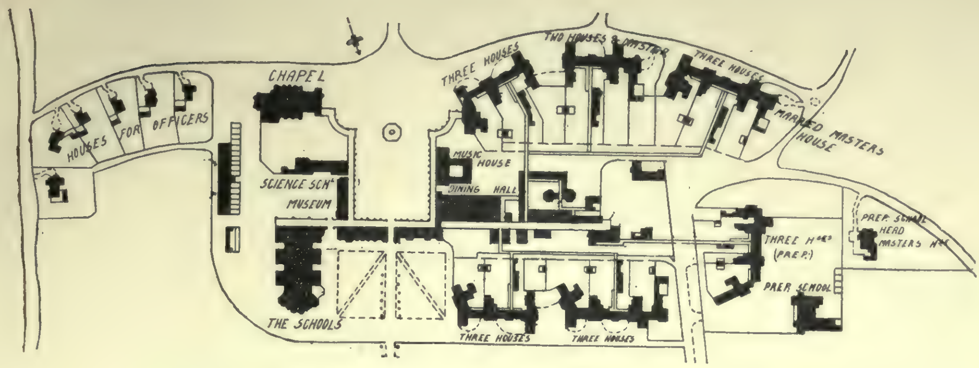
* See page 245.

175. NEW BUILDINGS FOR C

RIST'S HOSPITAL, HORSHAM.

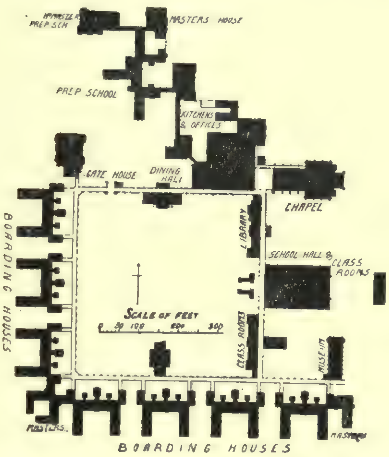
Aston Webb & Ingress Bell, Architects.

Between pp. 222 and 223.



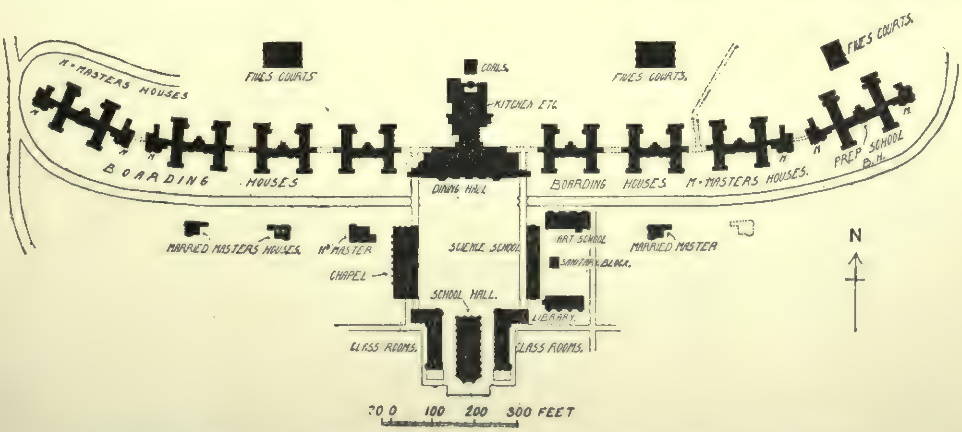
176. Competition Design for Christ's Hospital.

Paley & Austin, Architects.



177. Competition Design for Christ's Hospital.

Carpenter & Ingelow, Architects.



178. Block Plan of Christ's Hospital, New Buildings at Horsham.

Aston Webb & Ingress Bell, Architects.

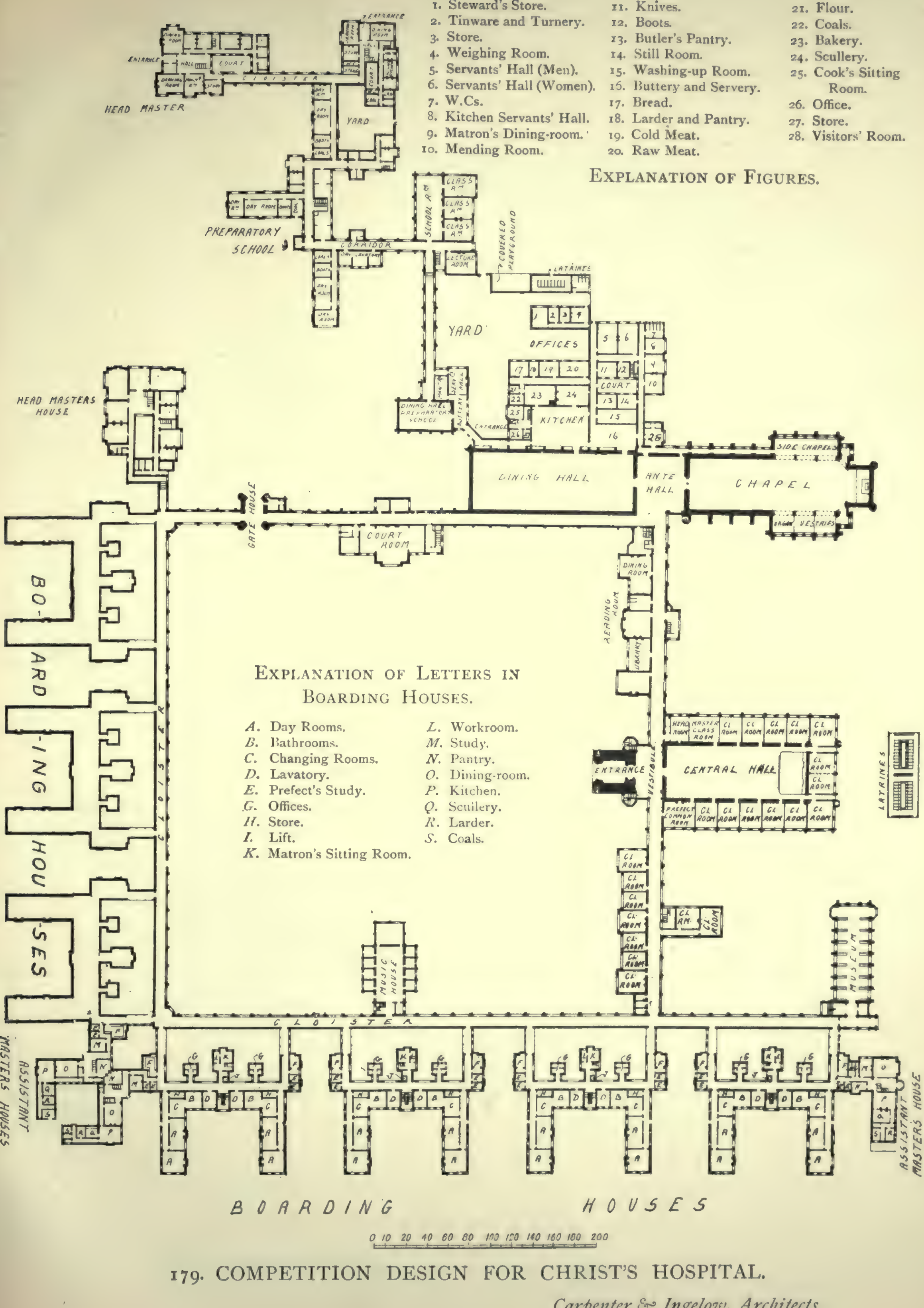
man walking upright. In this are carried all the hot-water and other pipes, wires, &c., so that inspection and repairs can be made easily. The heating is all done from a station situated at some distance from the school buildings, calorifiers being placed where required. The whole building has been very carefully arranged with everything that can be devised to ensure healthy and sanitary conditions.

The second plan shows the design submitted by Messrs Carpenter & Ingelow, which is a remarkable example of the adaptation of quadrangular system of planning to the needs of a large school. The scheme will be better understood by reference to the larger plan in Fig. 179. The general idea of the arrangement places the boys' boarding houses on the south and west sides ; on the east, the great hall with its class-rooms, the museum and chapel ; to the north, the dining-halls, kitchens, and offices, behind these being placed the Preparatory School. All the buildings are connected by the main cloister, so that it is possible to get from any one part of the buildings to any other under cover, while the houses being joined to this covered way by a short passage, it is possible to completely cut off any one of the houses if necessary. The boarding houses are arranged in blocks of two, each block accommodating 50 boys.

The third design illustrated, that of Messrs Paley & Austin, is not arranged on any exactly symmetrical plan. There is a large court facing south enclosed on three sides by a cloister, bounded on the east by the chapel, science schools, and museum ; on the west by the music school and one of the boarding houses. Entering the school through the clock tower, the educational part, *i.e.*, the school hall, class-rooms, and library, lies on the left or east, while to the right is the residential portion, the Preparatory School being placed on the same side, but farther west. The covered cloister, 15 ft. wide round the great court, enables access to be gained to and from all parts of the school buildings under cover. From each of the boarding houses, one of which is illustrated below,* leads a corridor of two floors to the main buildings, for school servants below, and for the boys above. The question of aspect has been treated rather curiously in this design, for of the six boarding houses three face south, the other three being arranged to face due north, an aspect which, although defended on some grounds for class-rooms, cannot be considered satisfactory for residential houses.

The Royal Masonic Institution for Boys, Bushey.—As a further example of the general scheme of a large plan there is illustrated the

* See page 246.



1. Steward's Store.
2. Tinware and Turnery.
3. Store.
4. Weighing Room.
5. Servants' Hall (Men).
6. Servants' Hall (Women).
7. W.Cs.
8. Kitchen Servants' Hall.
9. Matron's Dining-room.
10. Mending Room.
11. Knives.
12. Boots.
13. Butler's Pantry.
14. Still Room.
15. Washing-up Room.
16. Buttery and Servery.
17. Bread.
18. Larder and Pantry.
19. Cold Meat.
20. Raw Meat.
21. Flour.
22. Coals.
23. Bakery.
24. Scullery.
25. Cook's Sitting Room.
26. Office.
27. Store.
28. Visitors' Room.

EXPLANATION OF FIGURES.

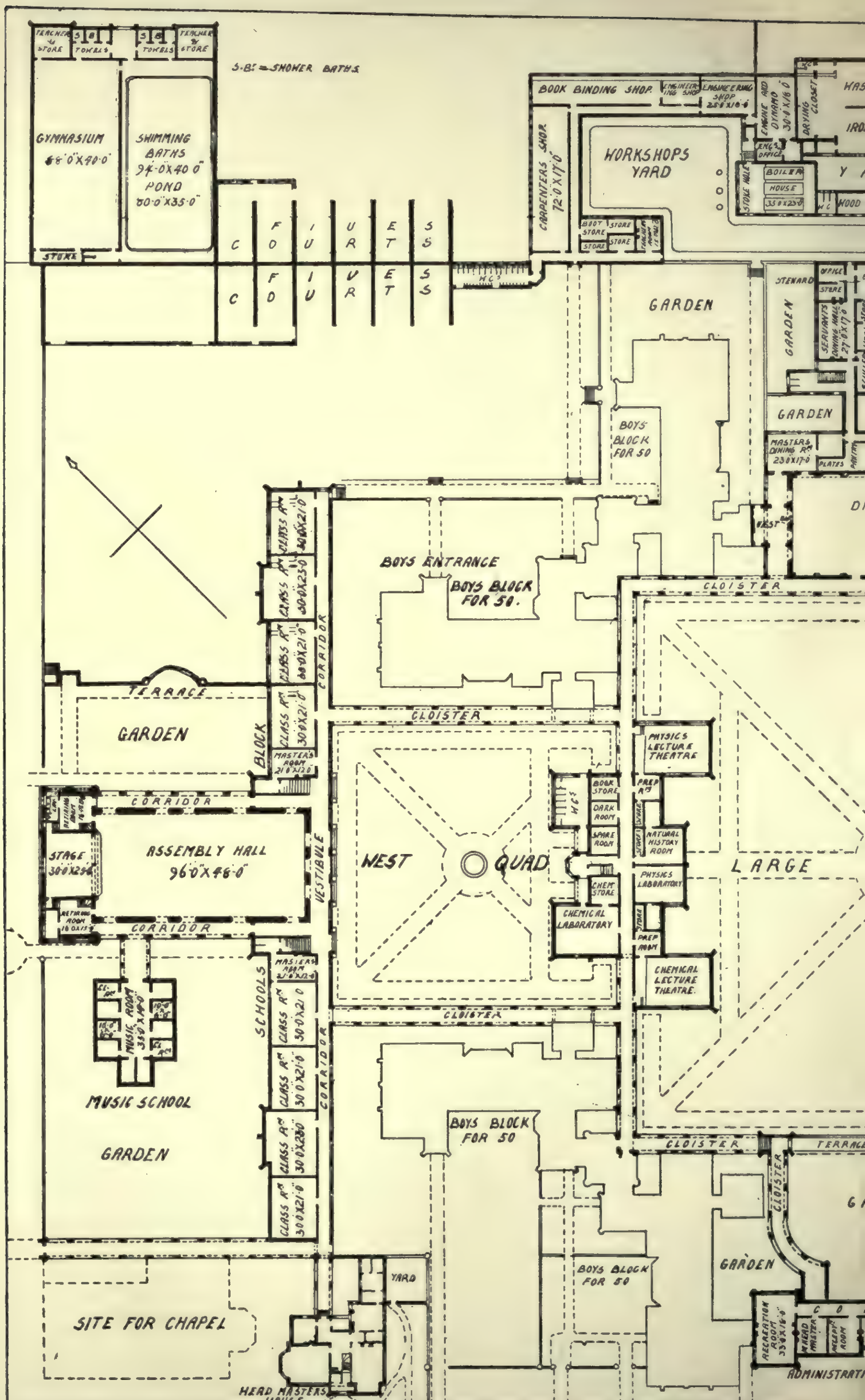
EXPLANATION OF LETTERS IN BOARDING HOUSES.

A. Day Rooms.
B. Bathrooms.
C. Changing Rooms.
D. Lavatory.
E. Prefect's Study.
G. Offices.
H. Store.
I. Lift.
K. Matron's Sitting Room.
L. Workroom.
M. Study.
N. Pantry.
O. Dining-room.
P. Kitchen.
Q. Scullery.
R. Larder.
S. Coals.

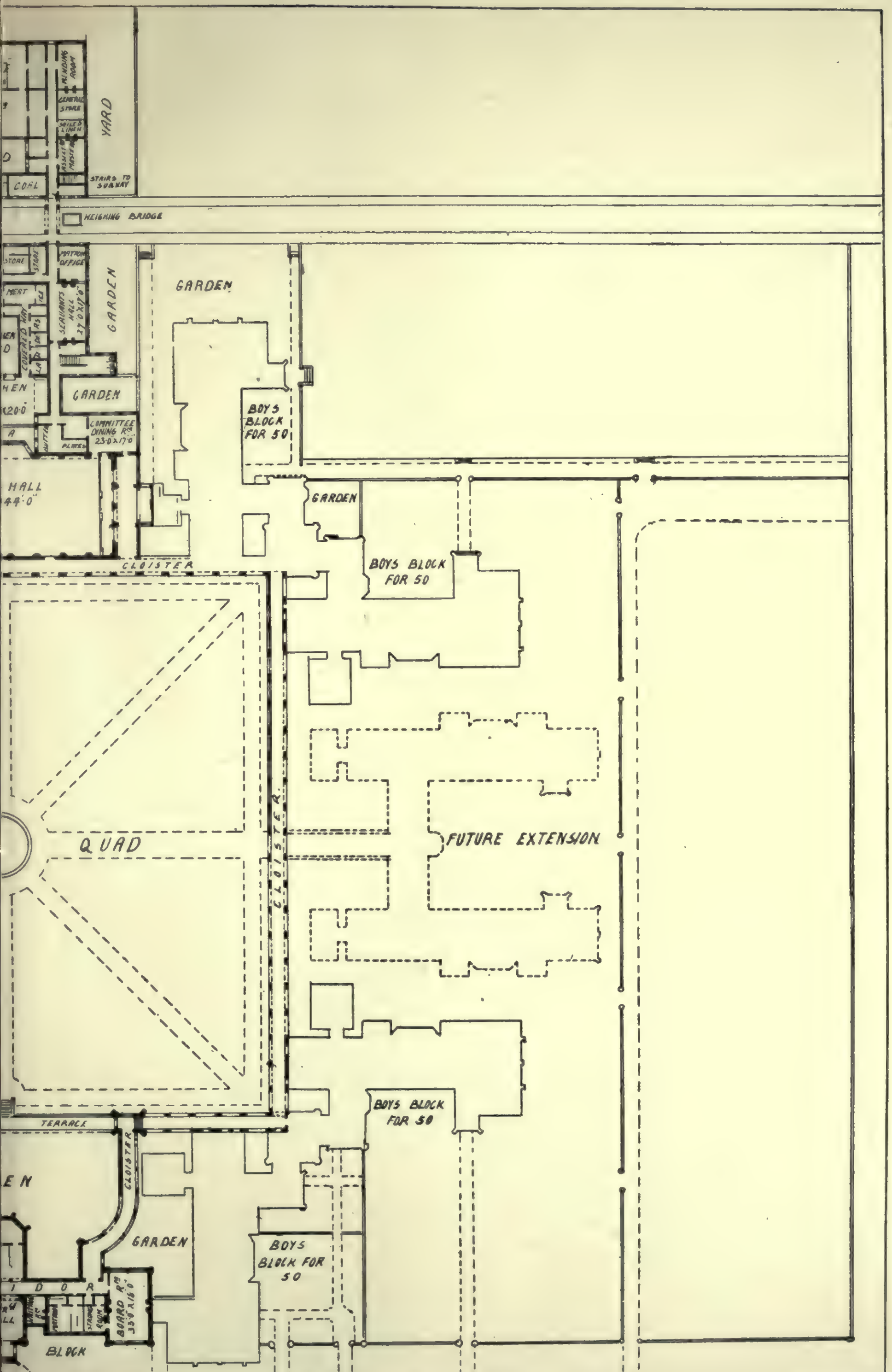
179. COMPETITION DESIGN FOR CHRIST'S HOSPITAL.

Carpenter & Ingelow, Architects.

To face p. 224.



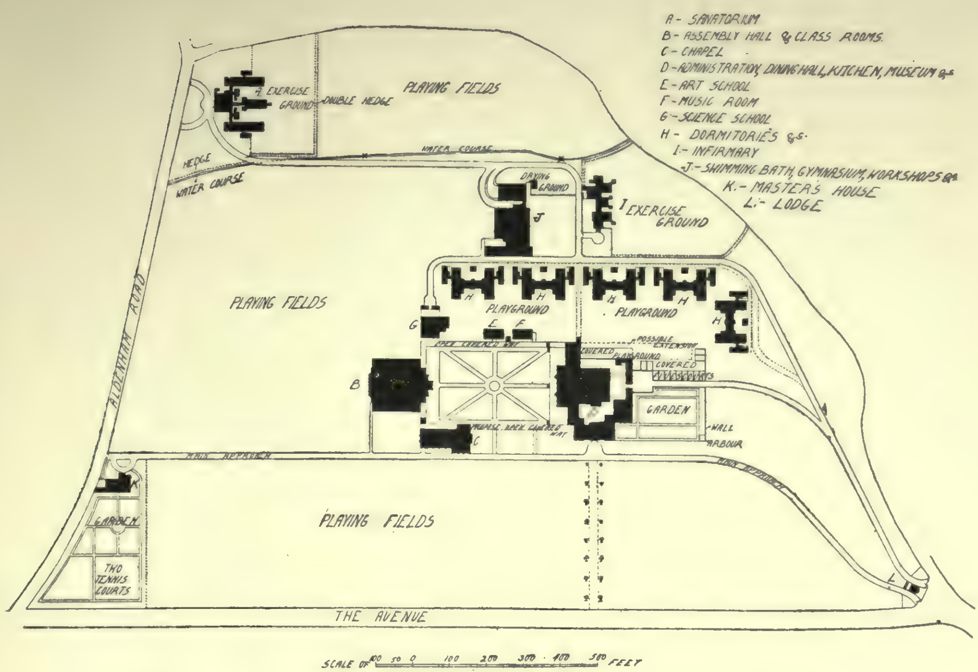
180. THE ROYAL MASONIC INSTIT



ION FOR BOYS, BUSHEY. General Plan.

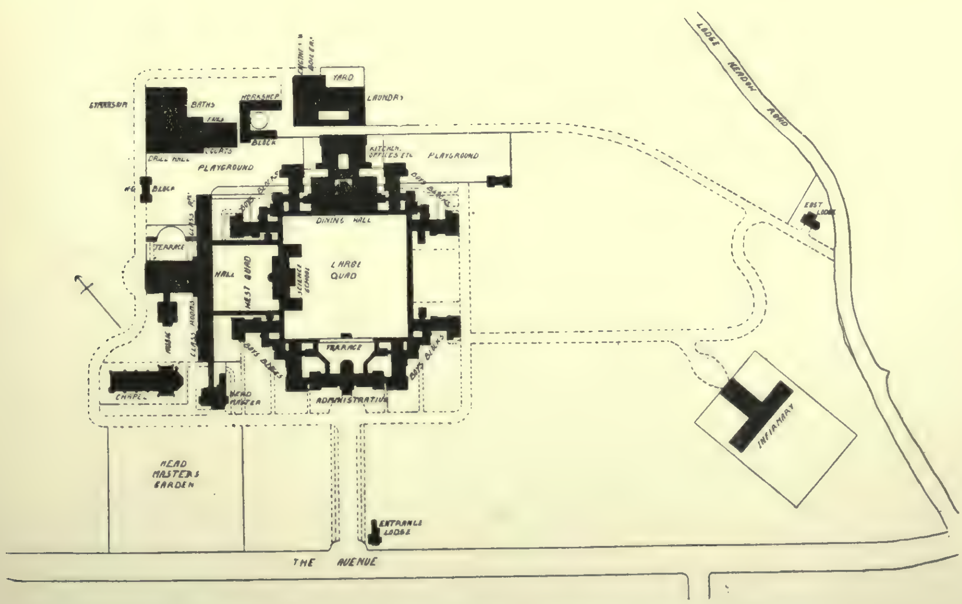
Gordon & Gunton, Architects.

Between pp. 224 *and* 225.



181. Competition Design for the Royal Masonic School, Bushey.

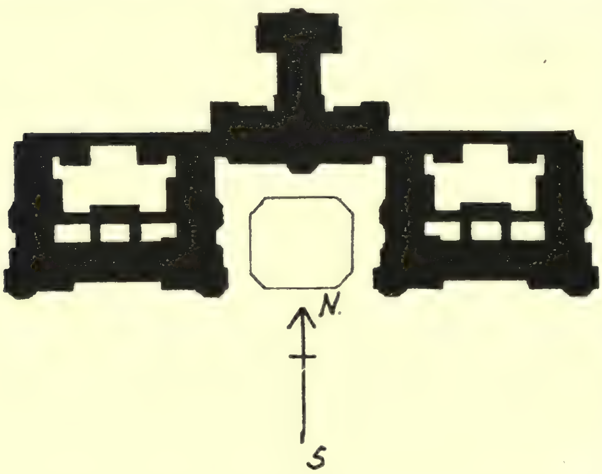
B. Champneys, Architect.



182. Block Plan of the Royal Masonic School, Bushey.

Gordon & Gunton, Architects.

plans of this school now in course of erection at Bushey. It offers a somewhat similar problem to the last on a rather smaller scale. The design illustrated in Fig. 180 was selected in a limited competition, and Messrs Gordon & Gunton were instructed to carry out the work. The winning design in this case is based on the system of quadrangles, of which there are two. Round the larger are ranged on the south-west the administrative block; the dining-hall, kitchen, and offices on the north-east; while at each corner is placed a double block of residential buildings. The science block is placed on the north-west side. Opposite to this a space has been left where another boarding-house can be erected should it be required at a future time. The smaller quadrangle leads to the assembly hall and class-rooms. The arrangement of the buildings can be clearly seen in the bird's-eye view shown in Fig. 183. The whole scheme is a good example of compact and ingenious planning, but it may be perhaps permissible to point out that from the point of view of health it suffers from disadvantages mentioned above, inseparable from a building planned symmetrically round a quadrangle. The placing of the boarding-houses at each angle of the square, as pointed out above, necessarily involves a wrong aspect for a certain number of them, while the compactness of the plan involves the use of a considerable number of small courts and confined areas.



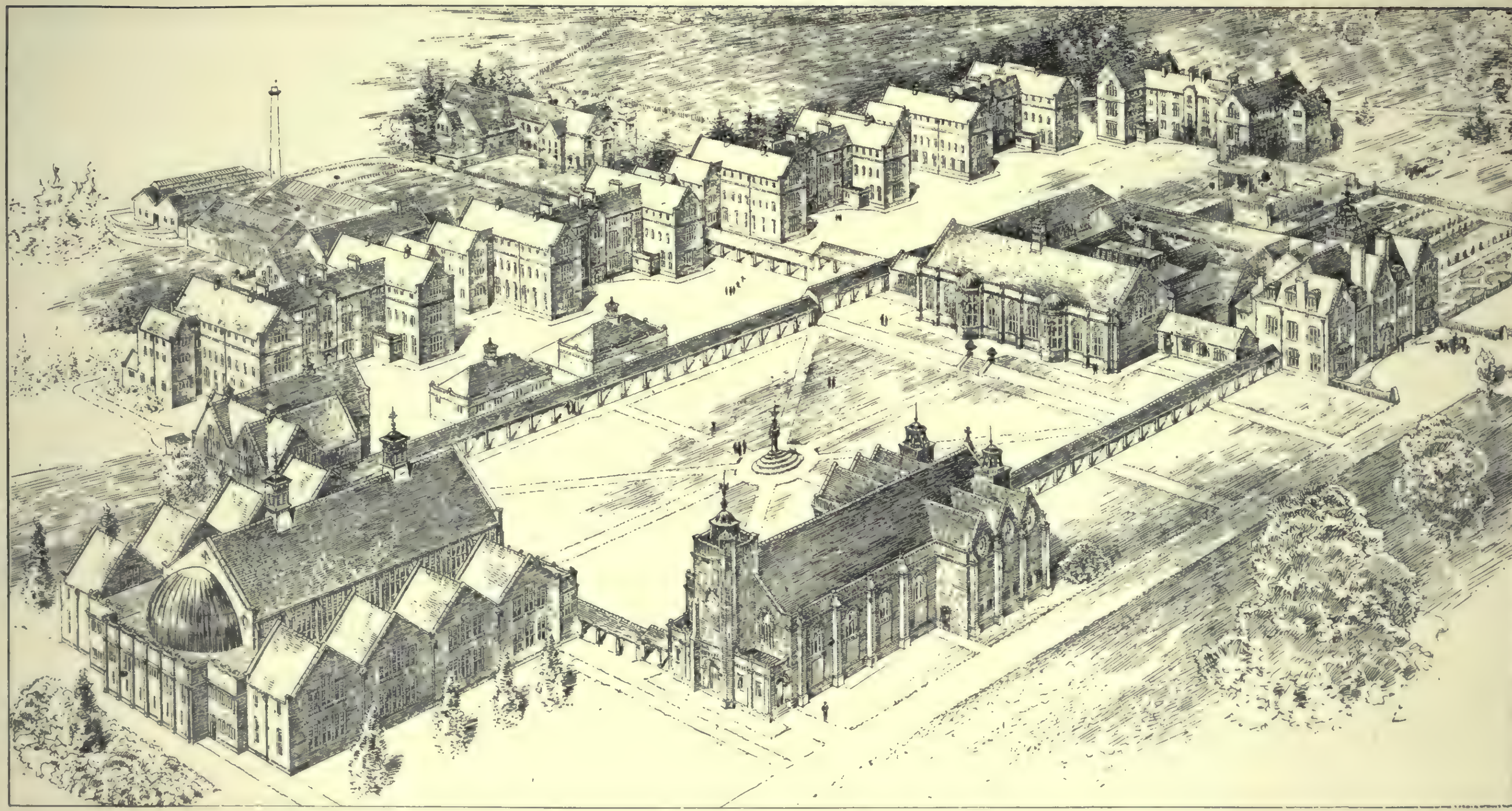
185. THE ROEDEAN SCHOOL, BRIGHTON. Block Plan.
J. W. Simpson, Architect.

For the purpose of comparison again there is illustrated in Fig. 181, the block plan of a competition design for the same school by Mr Champneys immediately above that of the school as carried out (Fig. 182). The idea of Mr Champneys' plan is well shown in the bird's-eye view in Fig. 184. In this case the school buildings form a block arranged round an oblong-shaped quadrangle, while the residential portion of the school is detached and arranged in five separate boarding houses, somewhat on the lines of the buildings for Christ's Hospital at Horsham.

183. The Royal Masonic Institution, Bushey.

To face p. 226.

Gordon & Gunton, Architects.



184. Competition Design for the Royal Masonic School, Bushey.

B. Champneys, Architect.

To face p. 226.

186. THE ROEDEAN SCHOOL. Inner Hall.

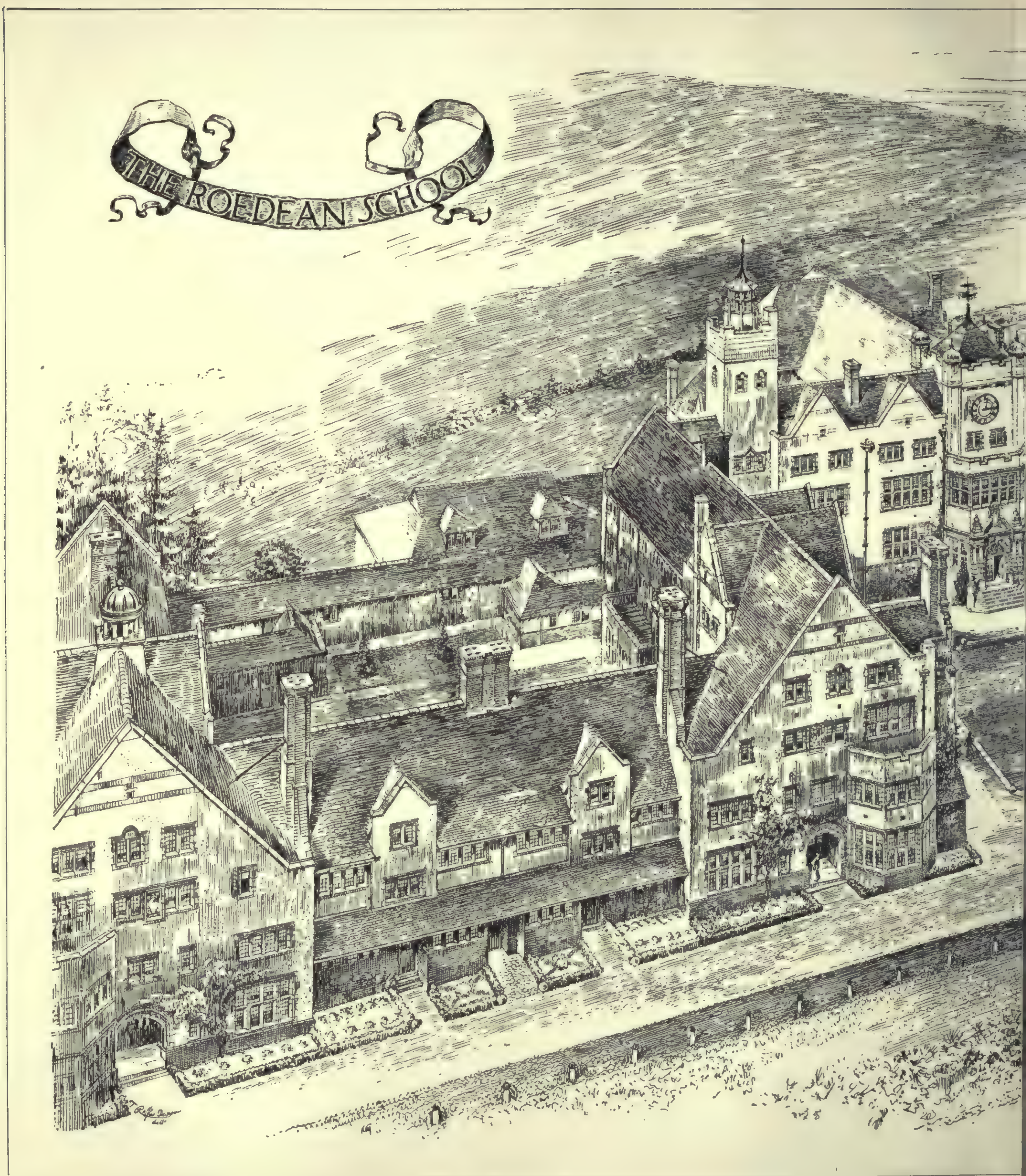
187. THE ROEDEAN SCHOOL. Main Entrance.

These two schools, one just completed, the other in course of erection, will give a good idea of the requirements and arrangements of a large Boarding School for boys. In one case the selected design is based on the quadrangular system; in the other, the larger, the open or divided plan. The latter plan, for reasons stated above, seems on

188. THE ROEDEAN SCHOOL. End of the Hall.

the whole the more satisfactory method for a school of any size, and will, if a prophecy be admissible, be probably the form upon which schools of the future will be planned.

The Roedean School, Brighton.—This shows an example of a Girls' Boarding School to take 200 girls, arranged in four separate blocks of



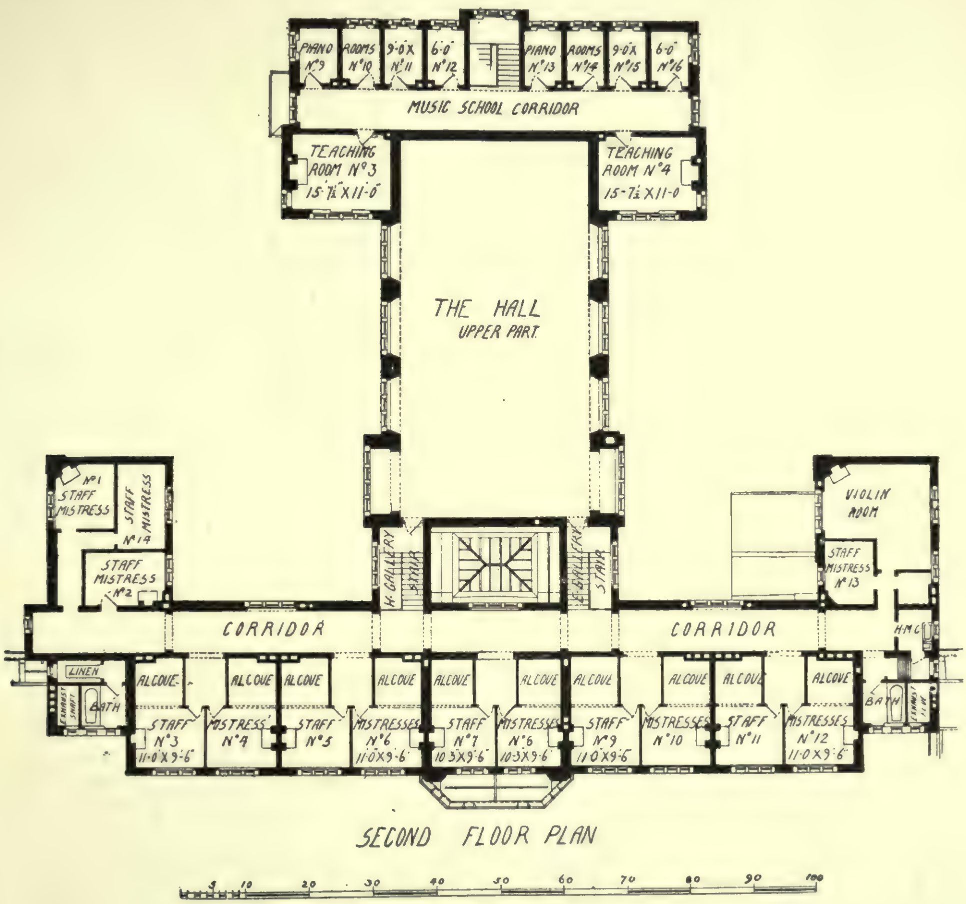
189. THE ROEDEA

SCHOOL, BRIGHTON.

J. W. Simpson, Architect.

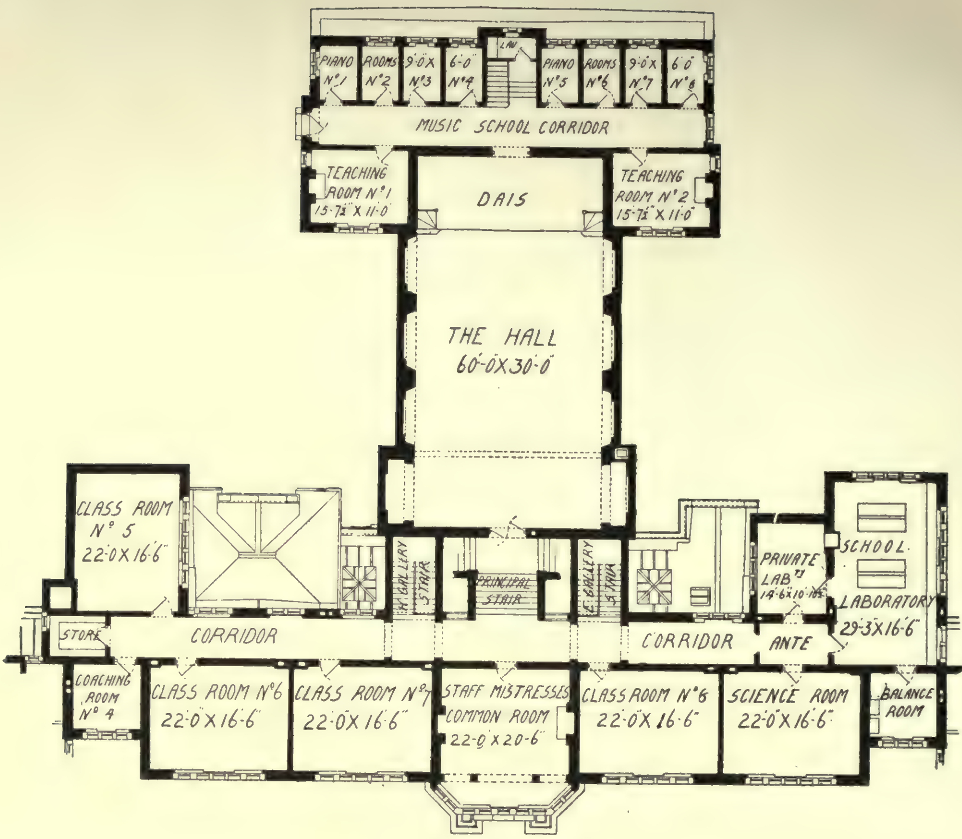
Between pp. 228 *and* 229.

houses, Fig. 185, all connected by one long corridor. The buildings (see bird's-eye view, Fig. 189) form an imposing front looking right over the sea to the south. The site itself is by no means an easy one on which to arrange a large block of buildings, as it slopes rather sharply. The block of school buildings, hall, class-rooms, &c., form the back of a quadrangle formed by the boarding houses, but which is

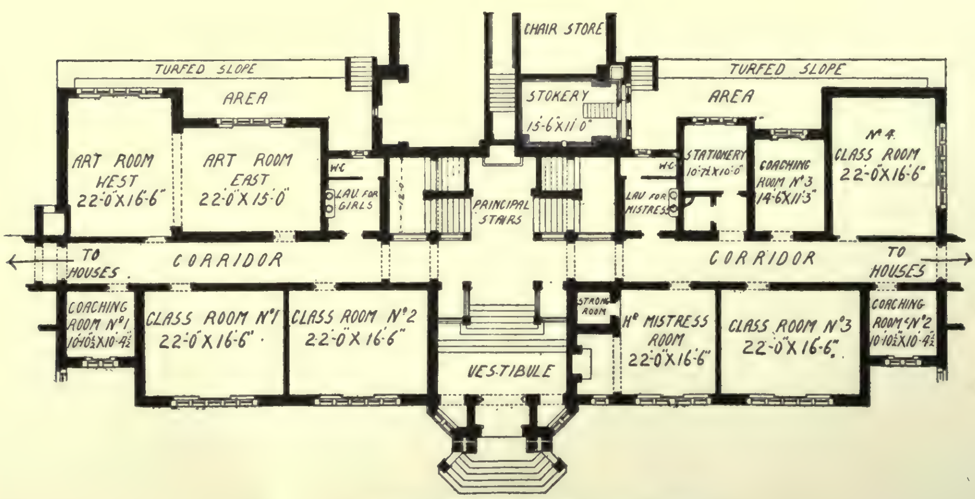


190. The Roedean School, Brighton. Central Block.

left open on the south side. This quadrangle, some 480 ft. wide, has a depth of 225 ft. The class-rooms, all measuring 22 ft. by 16 ft. 6 in., are placed on the ground and first floor, looking, with one exception, due south. Over them, on the second floor, are the rooms for the staff. These rooms look south and are made, by means of an alcove, to serve as bed and sitting room (see Fig. 190). The main entrance in the centre of the building leads into a handsome vestibule, with a wide flight of



FIRST FLOOR PLAN.

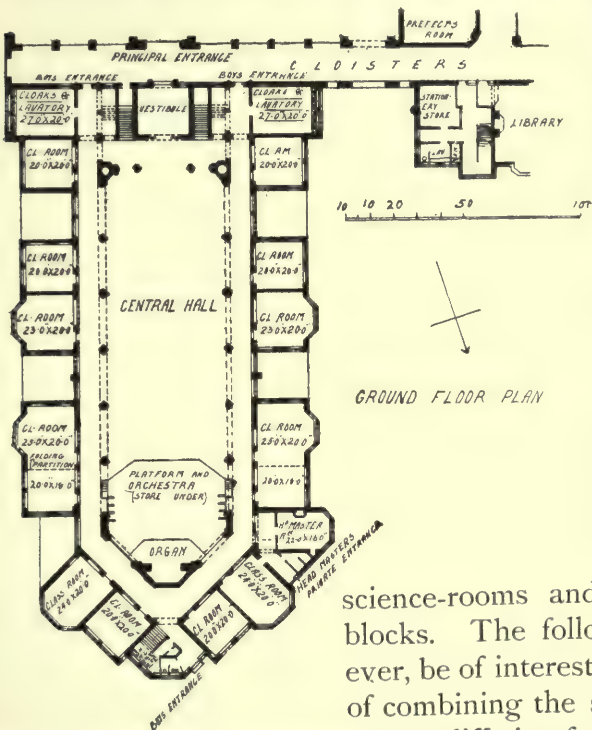


GROUND AND BASEMENT FLOORS

191, 192. THE ROEDEAN SCHOOL, BRIGHTON. Central Block.

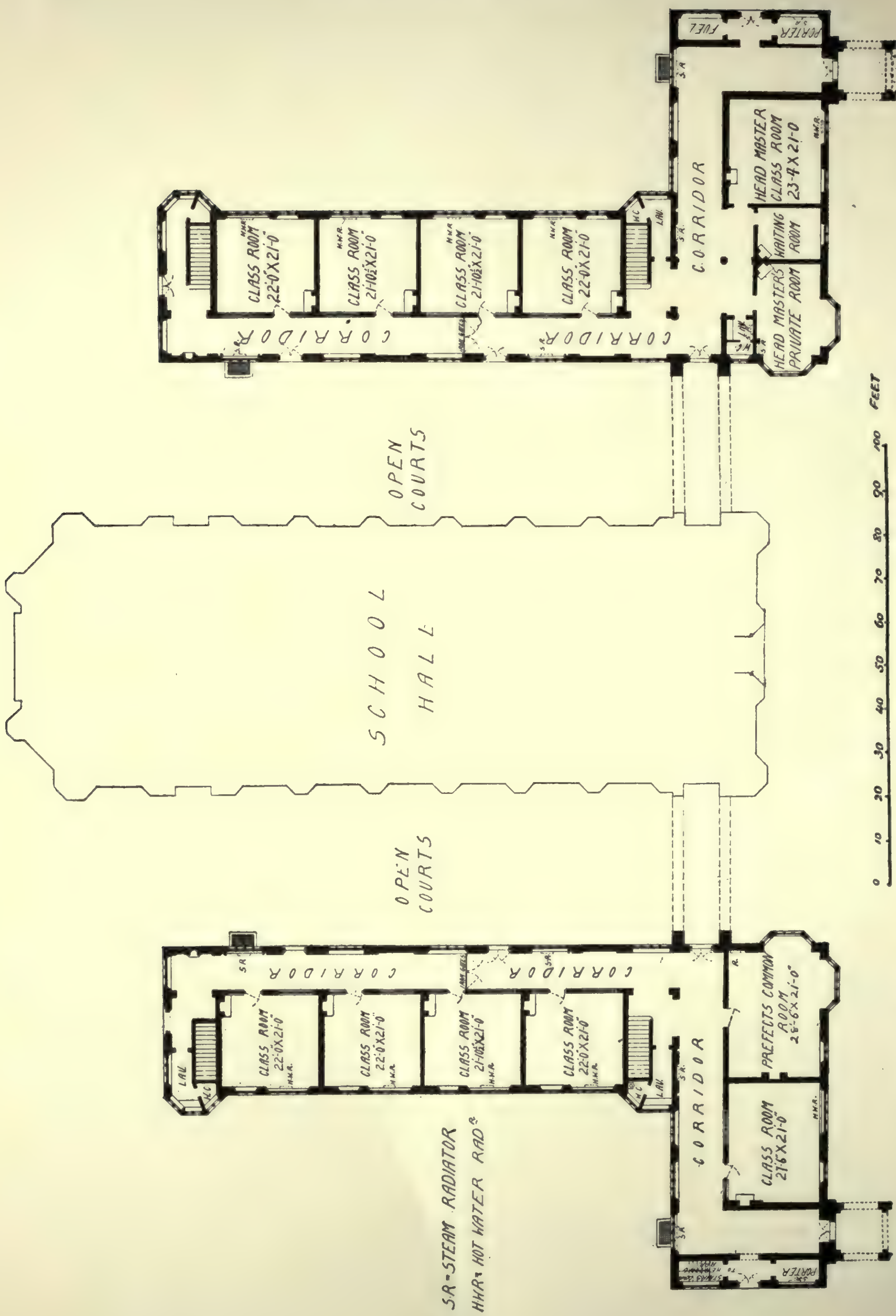
J. W. Simpson, Architect.

stairs (see Fig. 187) leading to the corridor which runs from one end of the school to the other, with which the different houses are connected. A second short flight of stairs leads to the hall (see Fig. 186). The hall, panelled with wood, and with open timber ceiling, has a rich and pleasing effect. At the farther end of this is arranged the Music School, so that all noise is effectively cut off from the rest of the school. There are sixteen practising-rooms and four for teaching, a retiring-room being provided for the music professor. One of the boarding houses is illustrated and described below. The building throughout has been treated artistically and decorated with great taste, the differences in levels offering opportunities for architectural effect, of which full advantage has been taken.



193. Competition Design for Christ's Hospital.
Hall and Class-rooms.
Paley & Austin, Architects.

As mentioned above, the educational requirements of a Boarding School do not materially differ from those of a Day School, except that the problem of arrangement is rather simplified by the lack of cloak-room requirements, and by the method usually adopted of putting the science-rooms and music-rooms in separate blocks. The following examples may, however, be of interest, as showing some methods of combining the school hall with the class-rooms, differing from those in the Day Schools figured above. In Fig. 194 are shown the class-rooms and hall as they are arranged at the new buildings for Christ's Hospital at Horsham. They are here arranged in two L-shaped buildings, the shorter arm being connected to the hall. The class-rooms themselves do not actually form part of the building, which of course prevents any possibility of supervision from the hall itself. The Headmaster's room is placed at the end of the corridor in one block, while the prefect's room occupies a similar position in the other. This arrangement will probably prevent any tendency to disorder in

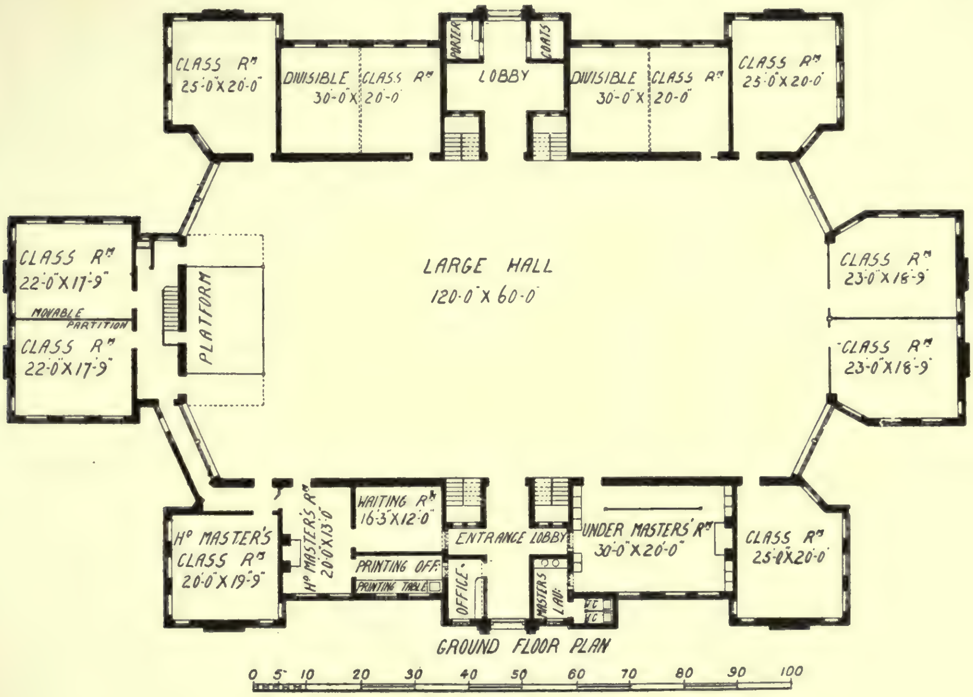


194. THE NEW BUILDINGS FOR CHRIST'S HOSPITAL, HORSHAM. The Hall and Class-rooms.

Aston Webb & Ingress Bell, Architects.

the corridor. This separation of the class-rooms from the main block will enable very free ventilation to be obtained. The hall runs north and south, so that the class-rooms face east and west.

Fig. 193 shows from Messrs Paley & Austin's competition design for the same building, the hall and class-rooms. They are here grouped in pairs presumably to allow of light being obtained in each case on two sides, while at the same time making it possible to get windows into the hall. It is difficult to altogether



195. Competition Design for Bedford Grammar School.

Hall and Class-rooms.

B. Champneys, Architect.

approve of this ingenious plan, as the windows in the end wall will have to be either in the eyes of the teachers or pupils, while the class-rooms are not of a sufficient size to require light from more than one side.

Fig. 195 shows another design, by Mr Basil Champneys, taken from a competition design for the Grammar School at Bedford. This is an attempt to place the class-rooms so that they shall open off the central hall, and yet still make it possible to have large windows into the hall.

KITCHENS AND OFFICES.

In large schools where the whole school take all their meals in the central hall, the kitchens have naturally to be on a large scale, and are differently arranged to those in a house where not more than 40 or 50 have to be catered for. The connection between the kitchen and the dining-hall is naturally of great importance in order to save waste of time. It is not easy to say exactly what rooms it is essential to supply, but it is hoped that the following list will mention at least those that are necessary.

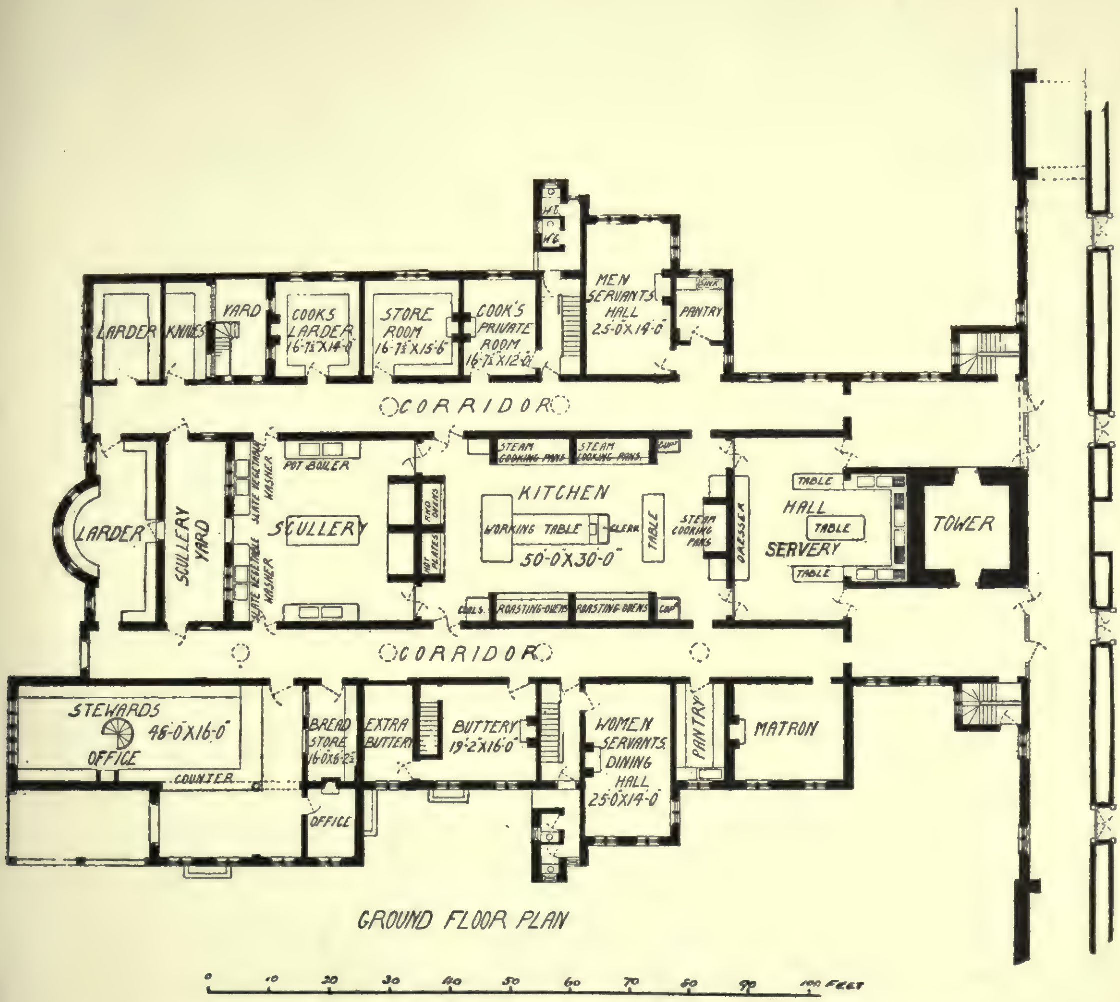
Kitchen.—The main kitchen should of course be of considerable size, well lit and ventilated. As it is usually fitted with steam cooking and roasting ovens round the greater part of the wall space, allowance for the loss of some 3 ft. all round should be made. For this reason top lighting is an advantage owing to the increase of wall space. The main kitchen at Christ's Hospital, where there are between 800 and 1,000 to be fed daily, measures 50 by 30 ft. That at the Masonic Institute, where about half that number have to be provided for, measures 34 by 22 ft.

Sculleries.—The scullery is often divided into two parts, a convenient plan, as the vegetable cooking as well as washing is done there.

Larders.—Separate larders are usually provided for cooked and uncooked meat, milk, bread, pastry, and vegetables, though of course these are sometimes combined ; a cook's store-room and grocery store, china and glass store, coal and wood and knives ; an office for the steward conveniently placed near the entrance, so that incoming stores can be checked easily ; a weighing bridge so arranged that heavy goods can be easily wheeled upon it for weighing ; a private sitting-room for the cook ; a matron's room in connection with the stores for clean and soiled table linen ; a separate dining-room for men servants and women servants, necessary conveniences, &c. ; buttery and pantry ; a large serving-room fitted with apparatus for keeping plates hot in close connection with the dining-hall.

In the kitchen arrangements for the new buildings at Horsham (see Fig. 196) simplicity and directness of access have been held chiefly in view. There is a large serving-room with a door at each end into the kitchen, and also two doors immediately opposite the down landing into the long corridor outside the dining hall. It will be noticed that the doors from the corridor to the servery are arranged each side

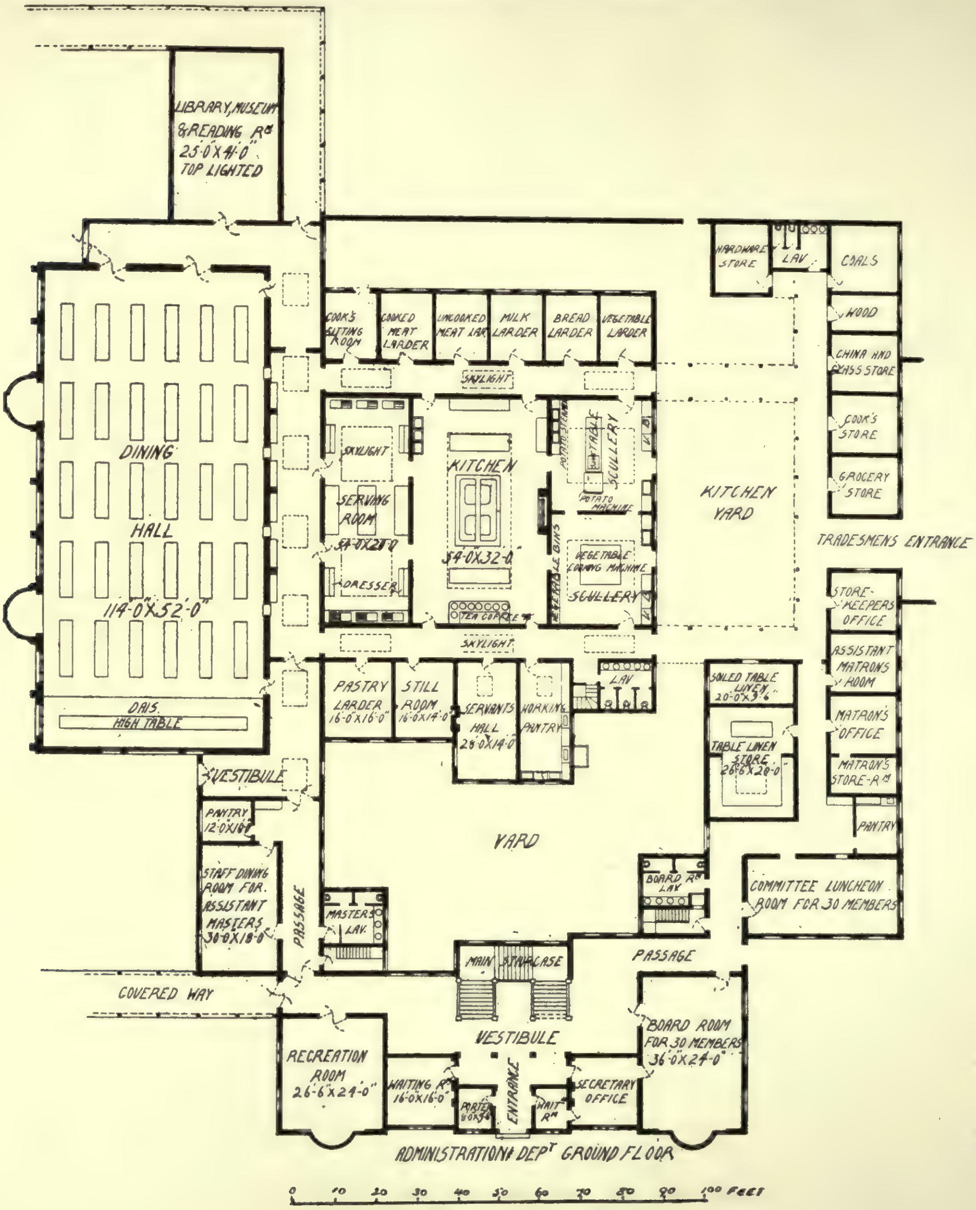
to allow of two streams passing in opposite directions. This arrangement is necessitated by the custom at the school of detailing a certain number of boys who come from the hall and fetch the dinner. This of course means large numbers continually passing each other. The



196. Kitchen Block, New Buildings for Christ's Hospital, Horsham.
Aston Webb & Ingress Bell, Architects.

plan (see Fig. 196) has been well arranged to provide for an easy circulation. A wide corridor is arranged outside the hall from which there are four double doors into the hall. To correspond with these there are four doors into the servery department. Two straight corridors run down each side of the kitchen and sculleries, off which

all the rooms open. By means of this a line of boys can come out of the hall, file through either the hall servery, kitchen, or scullery, and into the hall again by the opposite door, or *vice versa*.



197. Kitchen Block.

B. Champneys, Architect.

Fig. 197 shows a convenient and compact arrangement of dining-hall and kitchen, which provides a larger number of rooms but of

smaller size. It is intended to provide for about 500. This shows the administrative block as well. A large number of the offices are in this example situated in an annexe but connected by a covered way.

The kitchens and dining-hall of the Royal Masonic Institution can be seen in Fig. 180. This again is intended to provide for some 500. The kitchen is placed in the centre, and the other rooms and offices grouped round it. In the plans of St Paul's, West Kensington (see Fig. 112), is shown a neat and compact form of kitchens, &c., arranged on the top floor, and intended to supply one meal daily for about 200.

CHAPTER XIII.

BOARDING HOUSES.

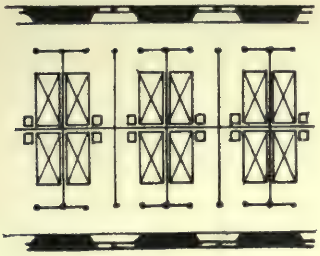
Dormitories or Cubicles, Arguments in favour of each—Cubicles, Size required and Arrangement of—Various Modifications between Cubicles and Open Dormitories—Area of Floor Space required for Sleeping Rooms—Examples of some recent Buildings—Distance between Beds—Washing Arrangements—**Day-rooms**, Size, Position, and Aspect—Furniture for—Monitors—Day-rooms in German Schools, Examples—**Changing Rooms,** Size and Arrangement—Other Rooms required in Boarding Houses—Illustrations and Descriptions of School Boarding houses—New Buildings for Christ's Hospital, Horsham—Messrs Paley & Austin's Competition Plans—Royal Masonic Institution, Bushey, a Competition Design—Boarding House for Cheltenham Ladies' College—Roedean School, Brighton—Colet House School.

THE most important question in relation to boarding arrangements is that referring to the dormitories and sleeping arrangements.

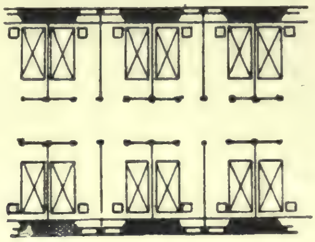
Dormitories and Cubicles.—It does not come within the province of a book of this sort to discuss the merits of the cubicle system as opposed to that of the open dormitory or that of large rooms with eight or ten beds; the question is very fully discussed by Dr Clement Dukes in his book "Health at School," and it will be sufficient to say here that the opinion both of Headmasters and of school doctors is very strongly in favour of the open room or small dormitory on all grounds. In vol. vi. of the Special Reports of the Board of Education are given the answers of the Headmasters of a number of Private Schools to certain questions on school management, and of 108 who replied in reference to cubicles and dormitories, 93 were in favour of the open rooms. It is not improbable that cubicles have come into use chiefly in deference to the wishes of parents, to whom the privacy thereby obtainable for the boys seems to offer many attractions. The system of having a small room for each boy, or one for two boys, which serves as sleeping, feeding, living, and working rooms, and which measures about 8 or 9 ft. square, though in use in some of our older schools, is one very unlikely to be repeated in a new building. The

necessity of shutting the bed up in a kind of box arrangement as soon as the occupant is up prevents any proper airing of the clothes, and is in every way objectionable.

A common arrangement is to put the younger boys in dormitories, providing cubicles for some of the older pupils.



198. Cubicles with Double Corridor.



199. Cubicles with Central Corridor.

Cubicles.—In providing cubicles, the usual plan is to have a long narrow room with windows down both sides, arranged with a passage down the centre, formed by the partitions of the cubicles, and into which they all open. These partitions are usually of wood, and are not as a rule carried up to the ceiling, but arranged to leave an

200. Interior View of a Dormitory, St Margaret's School, Bushey, showing Recesses at Head of Beds.

open space of 4 or 5 ft. above for the purpose of ventilation, the upper part of the partition being often provided with some sort of apparatus or wire or woodwork, to prevent any too adventurous spirits climbing about on the top. The size of a single cubicle varies from 6 ft. 6 in.

by 9 ft. to 9 or 10 ft. square. In German Boarding Schools when the cubicle system* is found, much the same measurements prevail. Figs. 198 and 199 show two methods of arranging the lines of cubicles and the corridors, the central corridor (Fig. 199) being obviously the more economical in space. There is practically no difference in the amount of actual floor area required for dormitories, whether cubicles are used or not, the same number of square feet of floor space per head having to be provided in either case. As regards the window, the plan usually adopted is to divide a window between two cubicles, as in Fig. 199. Various combinations have been tried in order to combine a certain amount of privacy with the advantages of an open dormitory. For example, as shown in Fig. 200, taken from the Clergy Orphan School at Bushey, a small partitioned-off place for washing, &c., is provided at the head of the bed. This is not an uncommon plan, and one which has been found satisfactory (see for plan of such rooms, Figs. 226 and 234).

Two beds placed side by side with a partition between of sufficient height and length to make a complete division enable a considerable gain in distance between the beds to be gained.

Area required.—Whether open dormitories or dormitories partitioned off into cubicles be used, there should be an allowance of not less than 60 sq. ft. of floor space per head. It may be of interest to give the figures of a few dormitories in recently erected buildings :—

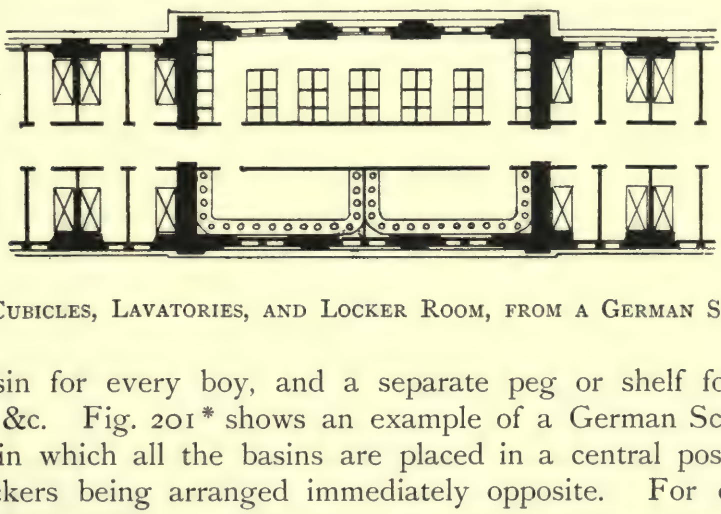
Leys School, Cambridge - - - - -	62 sq. ft.
Royal Masonic Institution for Boys, Bushey -	$56\frac{3}{4}$ „
Clergy Orphan School, Bushey - - - -	66 „
New Buildings, Christ's Hospital - - -	72 „
Messrs Austin & Paley's design for New Buildings, Christ's Hospital - - - - -	68 „
Dr Clement Dukes' model dormitory - -	88 „

The distance between the beds is usually from 2 ft. 3 in. to 2 ft. 6 in., the bed itself being 6 by 3 ft., and if possible not less than 5 ft. should be provided between the foot of one bed and that of the bed opposite ; but of course the more space that can be provided the better. Dr Clement Dukes † gives what he considers a model dormitory. The beds are 3 ft. 6 in. apart, with a passage down the centre of the room 11 ft. 6 in. wide in which are placed the basins. The room takes twelve beds, and measuring 46 by 23 ft.,

* This is usually only in Training Colleges, and even then chiefly for women students.
† "Health at School."

allows 88 sq. ft. per head, an amount considerably in excess of that generally found. In large dormitories it is usual to find at one or both ends a fair-sized cubicle, which is occupied by a monitor or prefect, who is placed there to keep order in the room. This room should have a window or opening giving a good view of the dormitory (see Fig. 205). In close connection with each dormitory or room, but cut off by a cross-ventilated lobby, should be placed one or two water-closets, for night use only. The most convenient plan probably is to have a small spur building in which they can be arranged one over the other for each floor (see Fig. 205). The closet for soiled linen can be well placed in this as well, and it should also be provided with two or three wash-hand basins.

The ordinary washing arrangements are placed either in the dormitory itself or in each cubicle, or else, as is without doubt the most satisfactory plan, in a special lavatory close by. There should of course



201. CUBICLES, LAVATORIES, AND LOCKER ROOM, FROM A GERMAN SCHOOL.

be a basin for every boy, and a separate peg or shelf for towels, sponges, &c. Fig. 201 * shows an example of a German School with cubicles in which all the basins are placed in a central position, the boys' lockers being arranged immediately opposite. For details of lavatory fittings, &c., see chapter on sanitation.

Day-rooms.—The day or living room should be a large well-lit room. Its shape is usually long and narrow, due to the fact that it is commonly placed under, and follows the same lines as the dormitory above. This room being the place where the boarders spend nearly all their out-of-school time, should be comfortable and roomy, placed so as to get plenty of sun. In calculating the area, not less than 20 to 25 sq. ft. per head should be allowed, but of course the larger and

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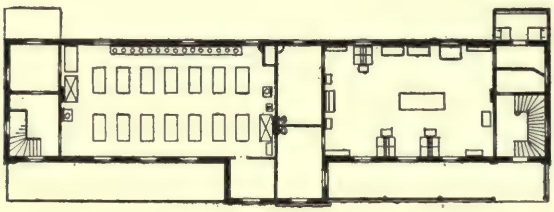
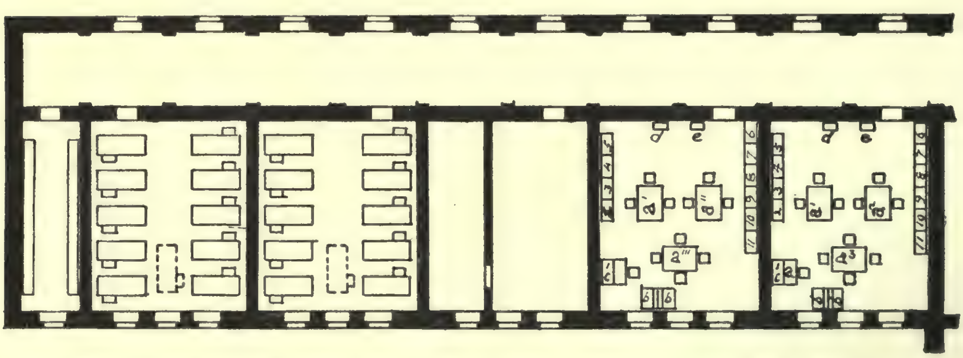
* Handbuch der Architektur.

brighter the room the better,* and it is not unusual to find as much as 60 sq. ft. The furniture may consist of tables and benches, or of box desks of which each pupil has one. In the former case a locker has to be supplied for each boy. These are sometimes arranged round the walls of the day-room, but the more satisfactory arrangement is to have a special locker-room. Where there is no dining-room, and the living-room has to serve for meals as well, it is naturally fitted with tables and benches. The plan of fixing them firmly to the floor will save a good many accidents, but it is essential that plenty of space for moving about be provided. In many cases a separate and smaller living-room is provided for the monitors or older boys in the house. In addition to these rooms there are often provided a number of little rooms, generally called studies, measuring about 6 or 8 ft. square. In some schools there is one provided for every boy, but perhaps more usually there are a certain number for the older boys. In German Boarding Schools there are, as a rule, day-rooms or living-rooms exactly corre-



202. Sleeping and Living Room.



203. Two Dormitories and Day-Rooms, with Masters' Room in the Centre, from the Joachimsthal'schen Gymnasium, Berlin.

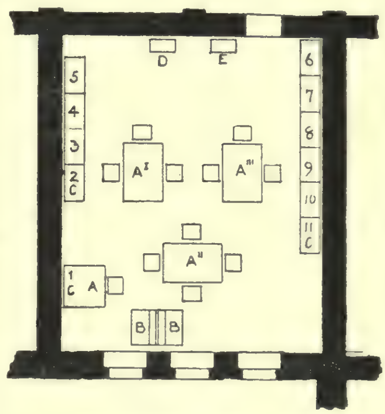
sponding to the sleeping-rooms, and generally arranged close together (see Fig. 202). These living-rooms are mapped out with an almost military precision. Not only is the position of each boy marked out and shown on the plans according to the form he is in, but the exact place of everything is shown, down to the waste-paper basket.

* In the new buildings at Christ's Hospital about 40 sq. ft. is given.

Fig. 203, taken from the *Handbuch der Architektur*, shows two sleeping-rooms to take 10 or 11 boys, and their corresponding living-rooms. Fig. 204 shows one of the living-rooms in more detail. Each boy, as mentioned above, has his allotted seat, and that marked "A" is a special desk for the head boy of the room, who is supposed to be responsible for the discipline. A special desk is often provided near the window for any boy who is short-sighted. Comfortable chairs are sometimes provided.

But Boarding Schools in Germany are not found to any large extent, and cannot be in any way compared to the position held by Boarding Schools in this country.*

Changing Rooms.—In order to obviate the necessity of boys going into the dormitories or bedrooms during the daytime, dirtying the floors, &c., with their out-of-door boots, it is necessary to supply a room or rooms for the purpose of changing into flannels. These rooms are preferably placed on the ground floor, and in close connection with the lavatories and latrines. Foot-baths in the proportion of one, say, to 15 or 20 boys are a useful addition, as are also shower-baths. Plenty of room is necessary, as it usually happens that all the boys are changing at the same time. Every boy of course has to have his place with a double peg for clothes, and a pigeon-hole underneath for football boots, tennis shoes, &c. This room requires careful heating and ventilation. It is as well that there should be in addition a drying-room for wet clothes. It should not be forgotten in dealing with this room that the money and other valuables which are often left in the clothes while the owners are out playing offer strong temptations with easy opportunities, and that however high the standard of the school, there are sure to be from time to time boys who will avail themselves of them. Making the room visible from several points either by glass partitions or otherwise will generally prevent anything of the kind.†



204. LIVING-ROOM FROM FIG. 199.

A. Head Boy's Place. A', A'', A'''. First, Second, and Third Table. B. Desk near window for short-sighted boy. C 1-11. Lockers for each boy. D. Basket for Paper. E. Waste Basket.

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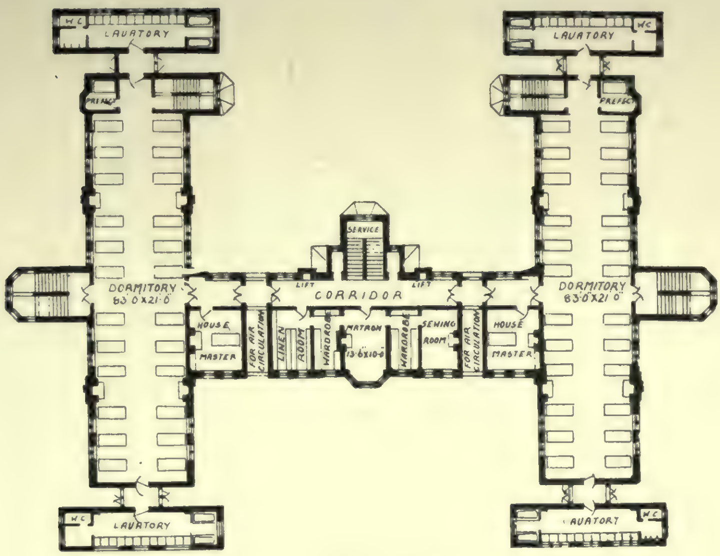
* For an interesting account of German Boarding Schools see "German Higher Schools," by J. E. Russell, pp. 196-212.

† See pages 152, 153.

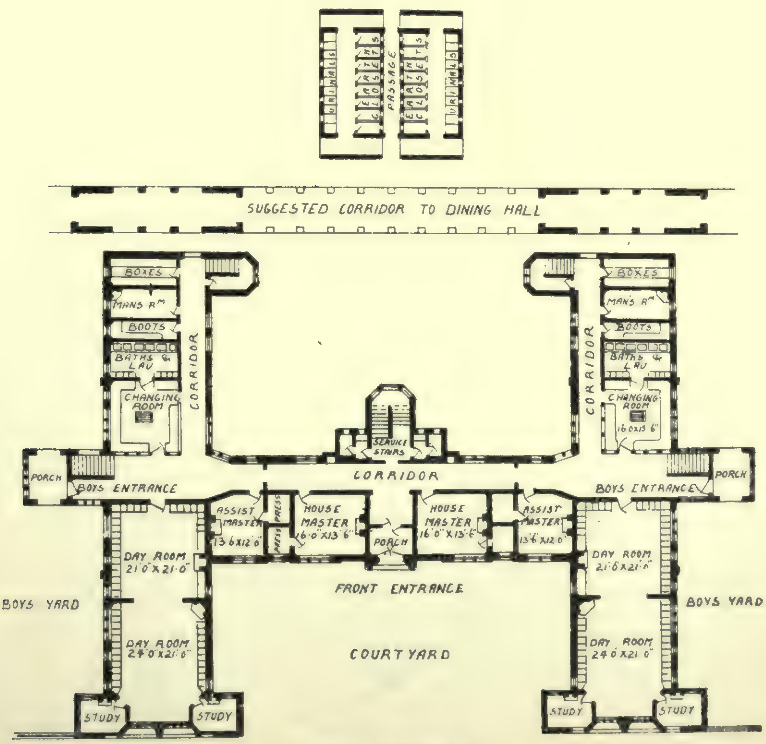
As regards size, there should, as mentioned above, be allowed as much as can conveniently be given, but if possible not less than 5 or 6 sq. ft. per head.

Other Rooms.—There are of course a certain number of other rooms found in a boarding house, according to the general arrangement of the school, such as the matron's room and linen store-rooms; a sick room or quiet room for boys with minor ailments not requiring treatment at the school infirmary or sanatorium; rooms for the house master—these sometimes take the form of a complete house of the ordinary kind attached to the boarding house; sometimes a bedroom and sitting-room is supplied for an assistant master as well. The offices, kitchens, &c., naturally depend on the question of whether the boys get their meals in their boarding houses, or whether they have them together in the central block. The various plans given will give an idea of the different arrangements and modifications of rooms supplied, &c.

Examples of Boarding Houses.—Figs. 205 and 206 show the plans of one of the boarding houses for the new buildings for Christ's Hospital at Horsham. These houses are arranged in two halves, the same in all respects, accommodating 50 boys each side in two dormitories. In the centre of the building are placed the house master's and matron's rooms; these are common to the two halves of the house, with ready access to either, but effectually separating the boys' part of the building. Each dormitory takes 24 boys, with a small room at the end for the prefect who has control of the room. At either end of the dormitory, cut off by an intercepting lobby, are the lavatories, each with accommodation for 12 boys, provided with twelve basins, two baths, four urinals, and a W.C. for night use. This arrangement is exactly repeated on two floors. The rooms are warmed and carefully ventilated, and have two staircases. On the ground floor there is the day or living room, a large cheerful room measuring 45 by 21 ft., and divided into two parts by an open arch. The boys' lockers are arranged round the walls, two studies being provided at one end for the prefects or monitors. To the north of the passage, but with windows facing east or west according to the half of the house, are placed the changing room, day lavatory, boot-room, box-room, and a room for the caretaker. All the rooms are decorated with a light green paint, and have a most cheerful and attractive appearance. In order to provide against any chance of stagnation in the air enclosed by the projecting wings of the



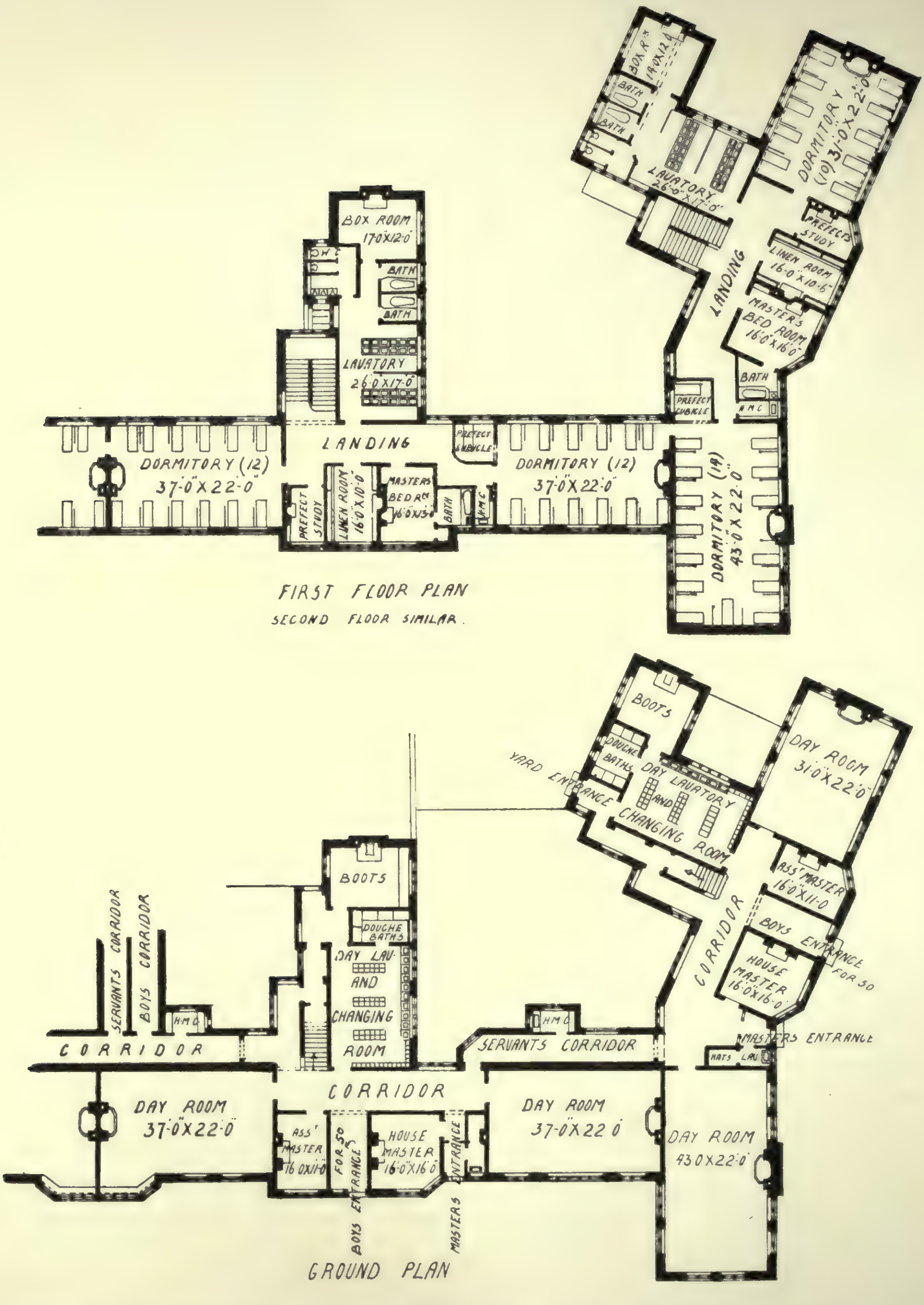
FIRST FLOOR PLAN.



GROUND FLOOR PLAN

205, 206. One of the Boarding Houses, New Buildings, Christ's Hospital, Horsham.

Aston Webb & Ingress Bell, Architects.



207, 208. A Boarding House. Competition Design for Christ's Hospital.

Paley & Austin, Architects.

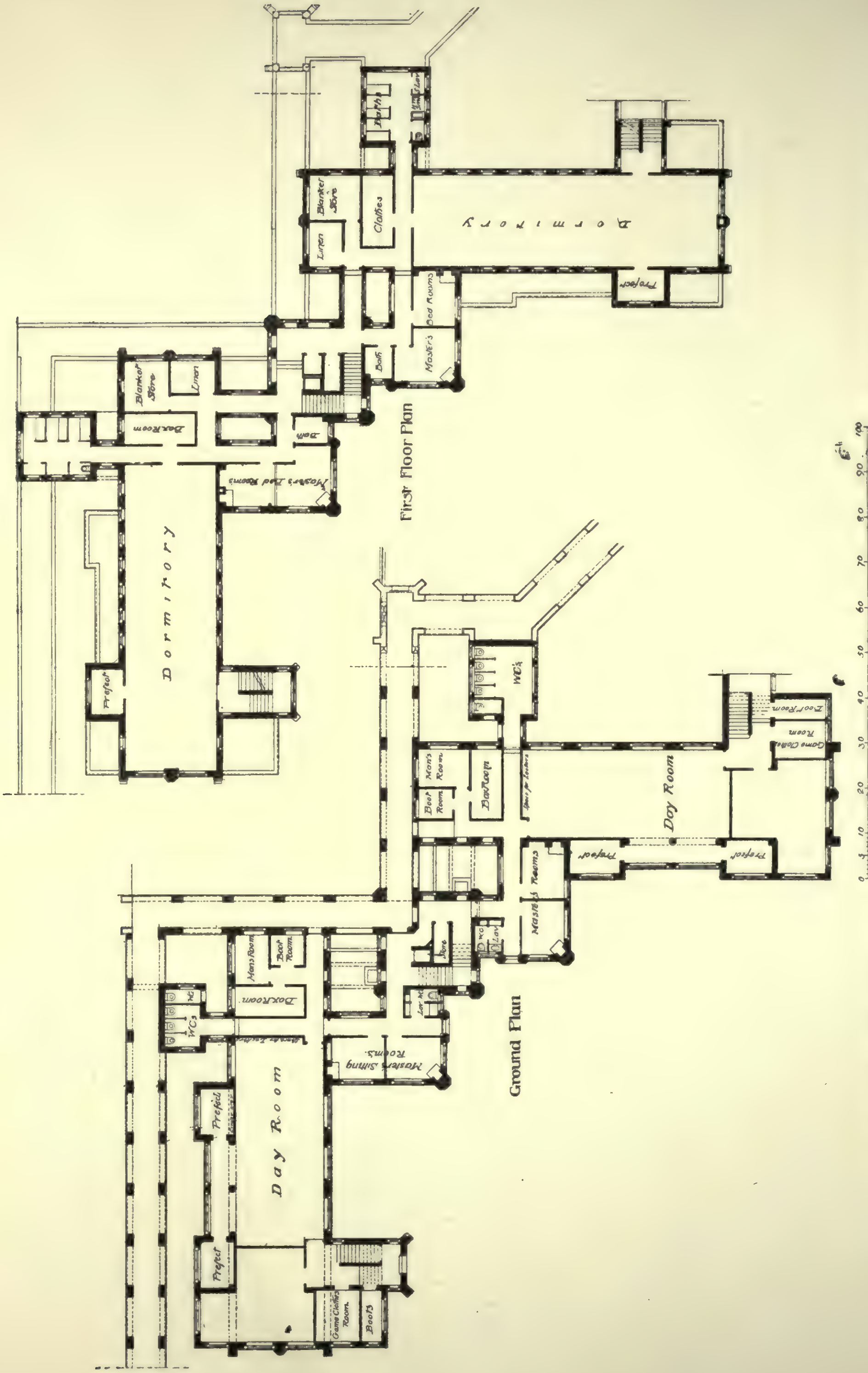
buildings, two large openings have been made right through the centre of the houses, the necessary space being gained by taking off from the height of the passage inside. These boarding houses should be inspected carefully, as an excellent example of compact and economical planning, in which every inch of space has been taken full advantage of. The convenience and safety of the sanitary arrangements, and the degree of comfort attained, while keeping the building to the simplest possible plan, are especially worthy of notice.

In Figs. 207 and 208 are given the plans for a boarding house as suggested by Messrs Paley & Austin in their competition design for the Christ's Hospital building. In this arrangement the dormitories are divided, each taking from ten to fourteen beds, giving 68 sq. ft. per bed, there being a prefect's cubicle provided in the two larger rooms. Each bed has a partition 4 ft. high, running from the head of the bed rather more than half-way down. The lavatories, &c., are arranged in two blocks, each accessible from two dormitories, with a basin to every boy. The day-room is again divided to correspond to the dormitories, and provides more room for each boy than in the preceding example, the changing room again being of considerable size, the plan on the whole being much less concentrated and less compact than that illustrated above, and also providing a larger area per head in all the rooms except the dormitories, where it is slightly less. These houses would no doubt be rather more expensive to build than the preceding, but would make comfortable and convenient residences.

Royal Masonic Institution, Bushey.—Figs. 209 and 210 show one of the corner blocks of this school. For the general arrangement see Fig. 180. Each of these blocks contains accommodation for 100 boys, arranged in two divisions of 50. Rooms for two masters are placed in each division. On the ground floor is placed the day-room with two prefects' studies opening into it. A changing room, boot-room, and man's room are also provided. The necessary lockers are arranged on the end walls of the day-rooms. Over this are placed the dormitories, with linen, clothes, and blanket store. Three baths and small lavatory are placed in an annexe close to each dormitory.

In Figs. 211-213 is shown a suggested design for a boarding house forming part of a design by Mr Champneys.* This shows a very compactly arranged house. On the ground floor the day-room is divided into two equal halves, with a prefect's study opening off each. The lavatory is placed on the ground floor in connection with the

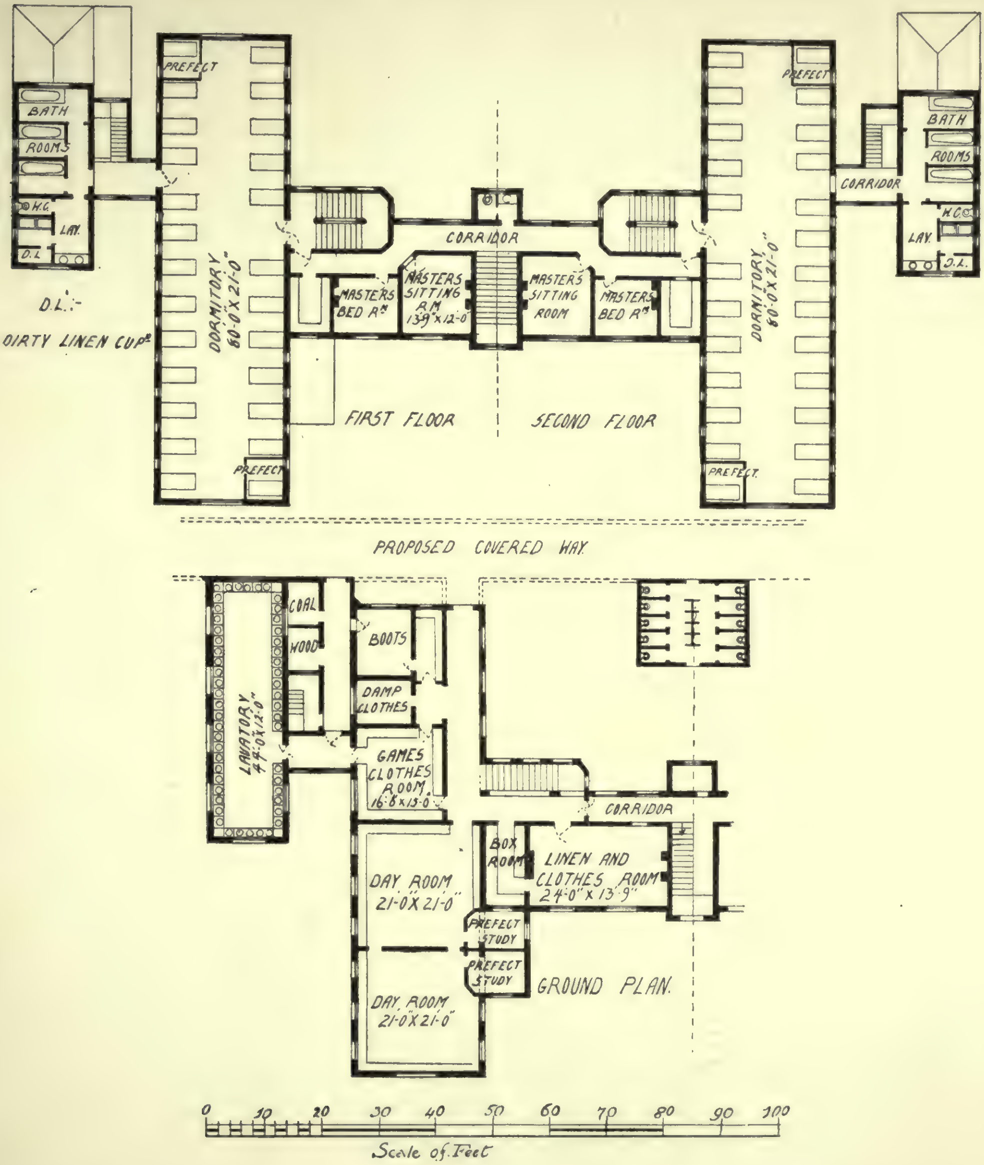
* Competition design for the Bushey School.



209, 210. THE ROYAL MASONIC INSTITUTION FOR BOYS, BUSHEY. One of the Corner Blocks of Boarding Houses.

Gordon & Gunton, Architects.

changing room. Each dormitory has an annexe for sanitary arrangements, cut off by an intercepting lobby, providing three baths for each 25 boys.



211-213. A Boarding House from a Competition Design.

B. Champneys, Architect.

Boarding Houses for Girls.—In boarding houses for girls there is generally a much higher degree of comfort provided. The boarding houses attached to Cheltenham Ladies' College are

practically large dwelling-houses, arranged, as it were, with accommodation for an unusually large family. A large well-furnished drawing-room is used as the general sitting-room after the work of the day is over. In the most recent of these houses, erected at the end of last year (1901), there is accommodation for 40 girls. On the ground floor is the dining-room and a large work or preparation room, in connection with which are two smaller rooms which can, if required, be thrown into the larger. On this floor is also a large drawing-room, well furnished as in an ordinary house, where all the inmates collect during the evening. In the basement is arranged a playroom; next to this is the boot-room, with an ingenious arrangement for boots. The man's boot-cleaning room is placed next door, the dividing wall being formed of pigeon holes enclosed on either side by cupboard doors, so that by opening one side or the other the pigeon holes are accessible from either room. The girls put their boots into their pigeon holes, the doors are shut, and the boots are then cleaned and put back from the other side. The sleeping arrangements take the form of large rooms, each divided into four cubicles by wooden partitions or in some cases by curtains. These cubicles are of considerable size, measuring some 10 or 12 ft. square, and are arranged so that each one has a window. Baths are placed in convenient positions, in the proportion of one to every five girls. On the top floor is placed a sick ward, which can by means of an intercepting lobby be completely isolated from the house.

In Figs. 214-216 is shown one of the boarding houses of the Roedean School for Girls, Brighton.* The houses are connected with the main corridor by a passage, on either side of which are placed, close to the entrance, the lavatories, cloak-rooms, and offices. Along this passage are also arranged four studies for elder girls and their sitting-room, and on the side opposite to this the work or preparation room. The dining-room acts as a division between the girls' half of the building and the mistresses' and administrative blocks. On the second and third floors are the bedrooms, each girl having a small room to herself. The direction of the building being north and south, it has been possible to arrange that all these rooms face east and west, so that in every case they get the sun during some part of the day. There is a liberal provision of baths, five being placed at the end of a row of fifteen rooms. The plans are somewhat difficult to follow owing to the difference of levels, necessitated by the rapid slope of the ground.

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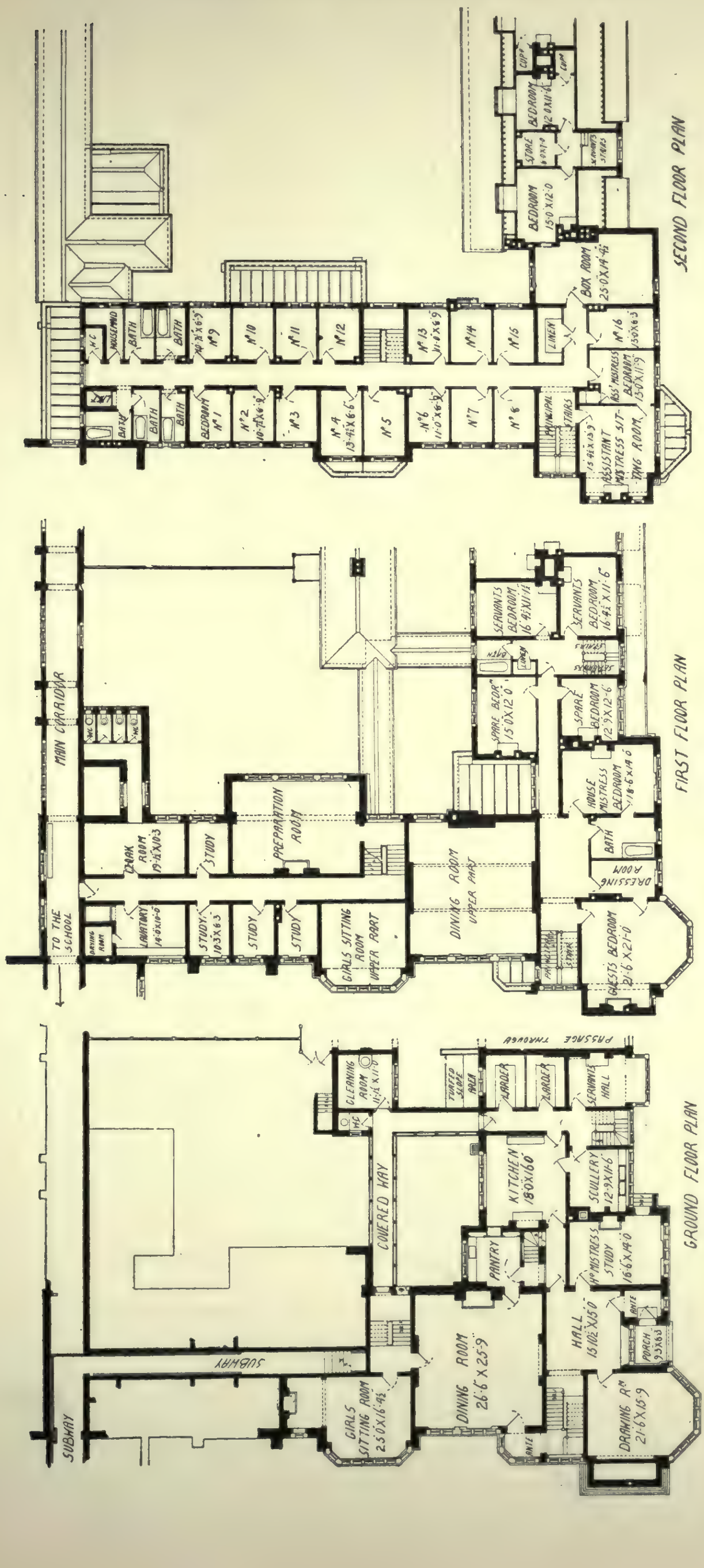
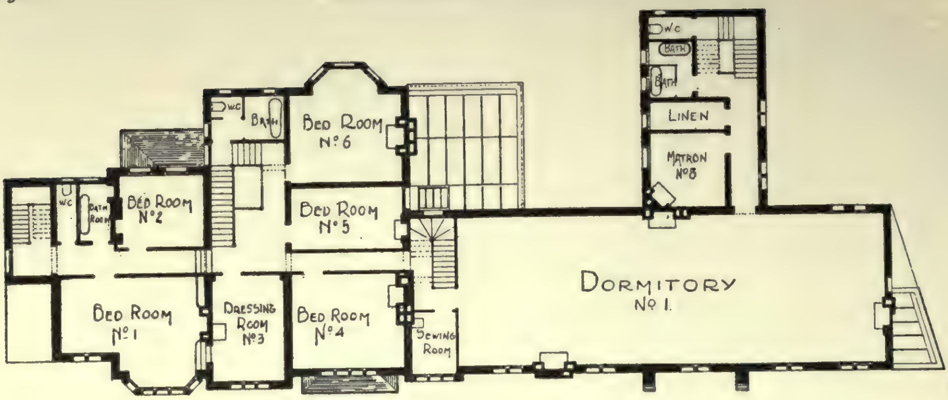
* For plans and description of rest of school, see page 228.

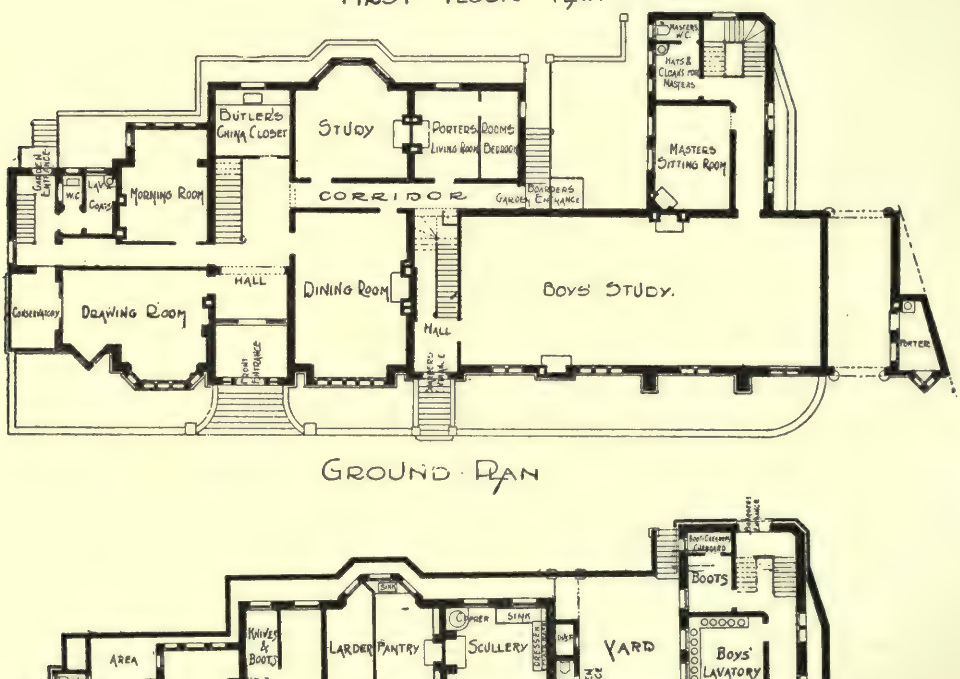


214-216. THE ROEDEAN SCHOOL, BRIGHTON. A BOARDING HOUSE.

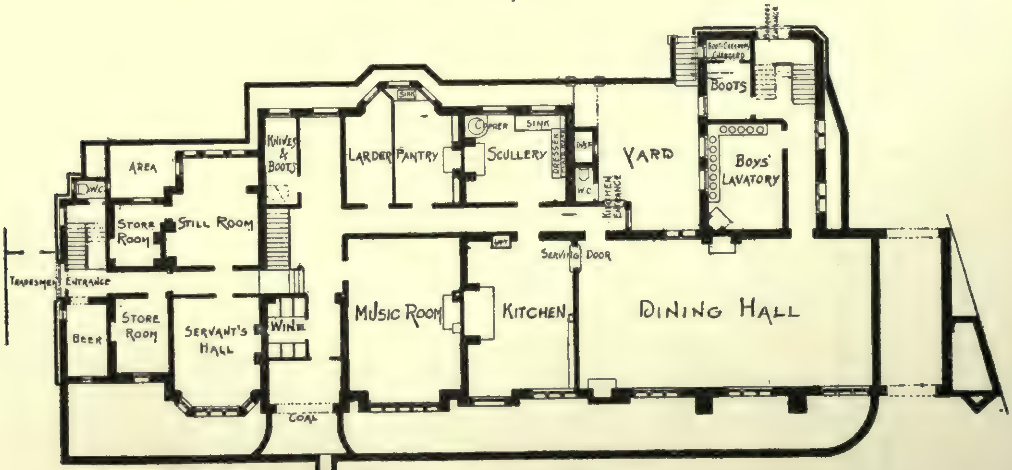
J. W. Simpson, Architect.



First · Floor · Plan



Ground · Plan



Basement Plan

10 5 0 10 20 30 40 50

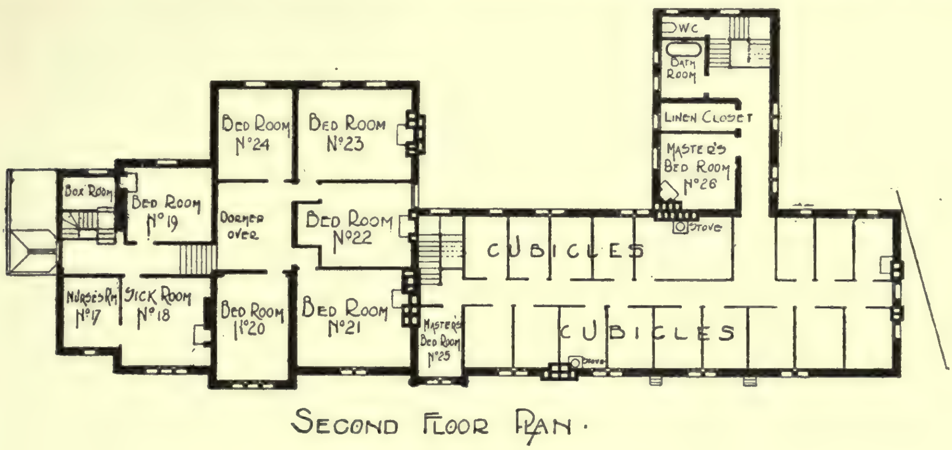
Scale of Feet

217-219. Colet House Preparatory School. The Boarding House.

W. H. Spaull, Architect.

As it is more usual in the case of Girls' Schools to have the residential and educational buildings in one block, there will be found more examples of sleeping arrangements for Girls' Schools in the next chapter when dealing with schools in one block.

Colet House Preparatory School.—This building (Figs. 217-220) serves as a boarding house for the school illustrated and described above (Figs. 66-68). The house is arranged with dormitories and cubicles, with a certain number of ordinary rooms in addition. A noticeable feature of the building is the large provision for exit in case of emergency, there being four staircases provided to the first floor,



220. Colet House School.

W. H. Spaull, Architect.

and three to the second and third. The staircases, after consultation with the best authorities, were constructed entirely of oak, as being the best fire-resisting material, since it is not only refractory in catching fire, but does not give way until almost burnt through. In the basement is placed the dining-hall, next the kitchen, and approached directly from the boys' entrance through the lavatory. A long room measuring some 56 by 24 ft., warmed by two fireplaces, and repeated on the four floors, forms the day-room on the ground floor, and dormitories above. A sick wing approached by a separate stair is arranged on the second floor.

CHAPTER XIV.

BOARDING SCHOOLS IN ONE BLOCK.

Preparatory School, Special Points in reference to—Playgrounds—Class-rooms—Special Rooms—Dormitories—Bedales School—St Margaret's School, Bushey—The Girls' Grammar School, Ashby-de-la-Zouche—New College, Hull—The Knaresborough Grammar School—The Bridlington Grammar School.

PREPARATORY SCHOOLS.

WHERE the school is not of sufficient size to entail the provision of separate blocks for residential purposes in addition to the school buildings, the arrangement, while of course involving much the same rooms, is necessarily somewhat modified. As a general rule Private and Preparatory Schools, being of smaller size, are arranged in one block. Although there is not much difference between the general arrangements of the buildings for a Preparatory School and for those which keep their pupils for a complete course of secondary education, it will be well to consider some of the points particularly applicable to Preparatory Schools before passing to the examples and illustrations of smaller Boarding Schools.

Private Preparatory Schools.—Private Preparatory Schools are in nearly all cases Boarding Schools, and although in some cases they admit a certain number of day pupils, such an arrangement is usually objected to, owing to the increased chances of infection and for other reasons. The boys usually enter the school soon after passing their ninth year, leaving generally before the age of fourteen, when they go on to the Public School for which they have been preparing. The number of pupils in these schools varies from about 20 to 60 or 70, though there are of course a certain number of a larger size. The keen competition among these schools in this country, and the high fees that they are able to charge if they can show successful results, has resulted in great completeness in equipment and general efficiency, upon which indeed their very existence depends.

The playgrounds and playing fields are as a rule very extensive, and comprise in almost every case a football ground and cricket ground, besides a good deal of space for various games, such as rounders, &c. A fairly liberal average in the case of Preparatory Schools would show about an acre to every 10 boys *—that is to say, the ordinary Private School of 50 or 60 boys would have about 5 or 6 acres. Fives courts and lawn tennis courts are usually provided.† A carpenter's shop is a common adjunct, as is not uncommonly a swimming bath. Gardens are sometimes found, but there seems considerable difficulty in arousing much enthusiasm for gardening among boys at school. A sanatorium standing some little way from the school is generally provided.

In Preparatory Schools the classes are small, and would as a rule average about 10. While in some small schools one or perhaps two classes will be held in the school-room or common living-room, it is usual now to find a class-room for every form. A convenient size for a class-room in a Preparatory School is found to be 18 ft. 6 in. by 16 ft. 6 in., which will allow plenty of room for movement, as it is customary at times to have the class arranged round the master in a semicircle for the purpose of place-taking—a fact which should not be lost sight of in considering the arrangement of the desks ; but it is as well to avoid what are known as "reversible desks," *i.e.*, which can be used either as a writing desk or as a seat with a back. In a room of the size mentioned, where the class does not exceed 10 or 12 pupils, there is plenty of room to provide single or double desks of the best type for writing, and to have a semicircle of forms with backs arranged for the purpose of forming the class round the master. With this addition the remarks on class-rooms for Secondary Schools will apply equally to those in Preparatory Schools.‡

Lockers.—It is necessary to supply a locker or cupboard for every boy, but not necessarily provided with a key. Sometimes these are placed in the school-room, or box desks are provided, or it may be only open shelves. The latter have the merit of making a certain amount of tidiness necessary, nor is it possible for things of a perishable nature to escape detection, and further it prevents the keeping of live stock in inconvenient places. At the same time it is a great hardship to a boy to have no private place where he can keep his

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* Special Reports, vol. vi.

† For plan of fives and tennis courts, see page 274.

‡ See Chapter VII.

possessions in a convenient and tolerably secure position. If possible these lockers should be put in the corridors where they can be easily got at without disturbing the school-rooms, unless a special room can be provided for the purpose.*

The provision of special rooms, such as a music-room, library, or museum, can hardly be considered necessary, though there should always be if possible a room where quiet reading can be carried on. If a room can be given up for this purpose, it may of course be well to combine with it the library, and also the museum if there is one.

Playroom.—In contrast to the room for quiet reading it is as well that there should be a room where at certain times unlimited noise is allowed. There seems a sort of craving in boys, especially young ones, for periods of unrestrained noise. Books on school hygiene tell us that it is necessary, natural, and most beneficial to the lungs. If there is a covered gymnasium, it may well serve for a playroom; but otherwise some outlet should be provided that will be available in wet weather and times when the playground cannot be used.

Dormitories.—The remarks and examples of dormitories given above (page 238) will apply equally to the case of Preparatory Schools. Cubicles are generally condemned for young boys. The usual plan is to have rooms or small dormitories taking from four to ten beds. Three beds should be regarded as a minimum.† In the sixth volume of the Special Reports issued by the Board of Education, which is devoted to the consideration of Preparatory Schools, are given the answers from 120 Private Preparatory Schools to certain questions asked them. It may be of interest to shortly summarise some of the results. The average numbers in the schools (120 answers) are given as just over 36; there is one resident master to every 8 or 9 boys, the classes usually being of that size. Nearly 70 per cent. supply a gymnasium, either open or covered; 27 per cent. show a museum; 56 per cent. a sanatorium, in a few cases not detached from the school; 18 per cent. supply a swimming bath, but not always warmed; 76 per cent. have a carpenter's shop; 37 per cent. have fives courts and tennis courts.

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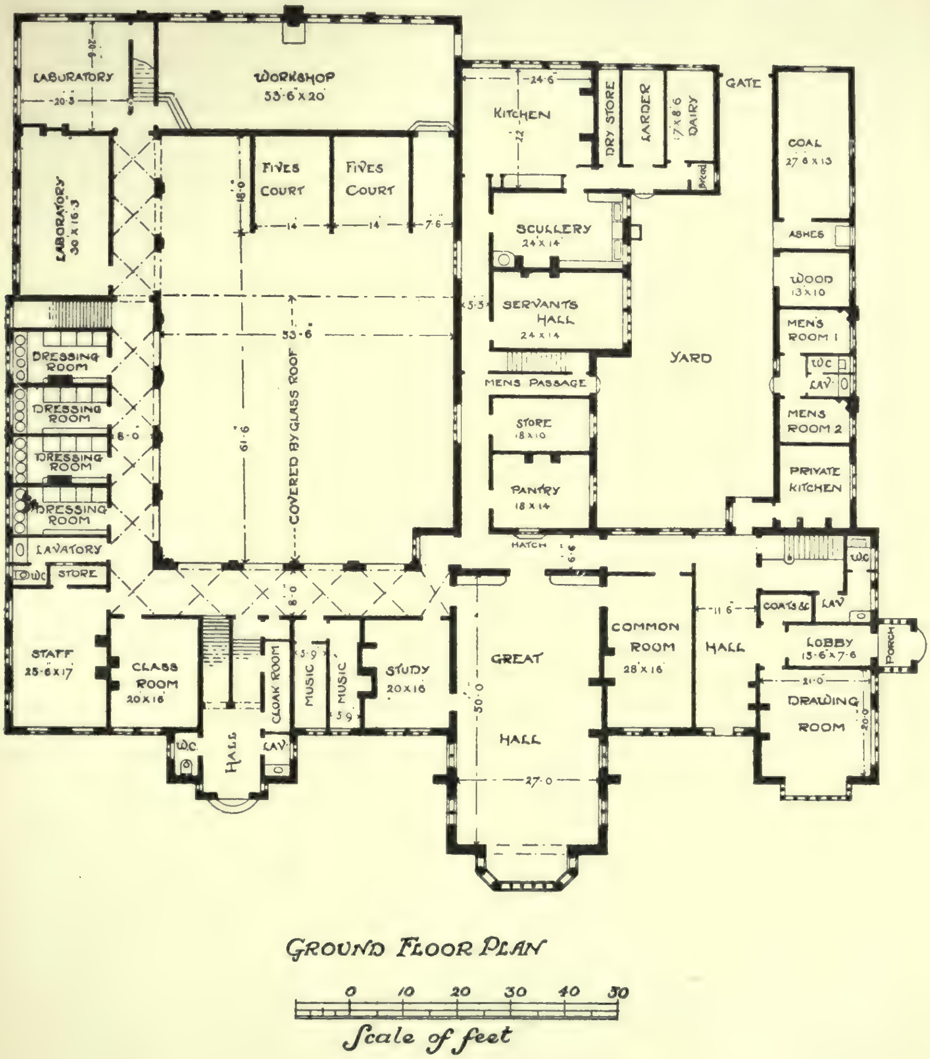
* In Boarding Schools for older boys lockers or cupboards with a key are always provided.

† Special Reports, vol. vi.

EXAMPLES OF BOARDING SCHOOLS COMPLETE IN ONE BUILDING.

Bedales School.—This (see Figs. 221-224) is a large Private School for boys and girls recently erected near Petersfield in Hampshire. The

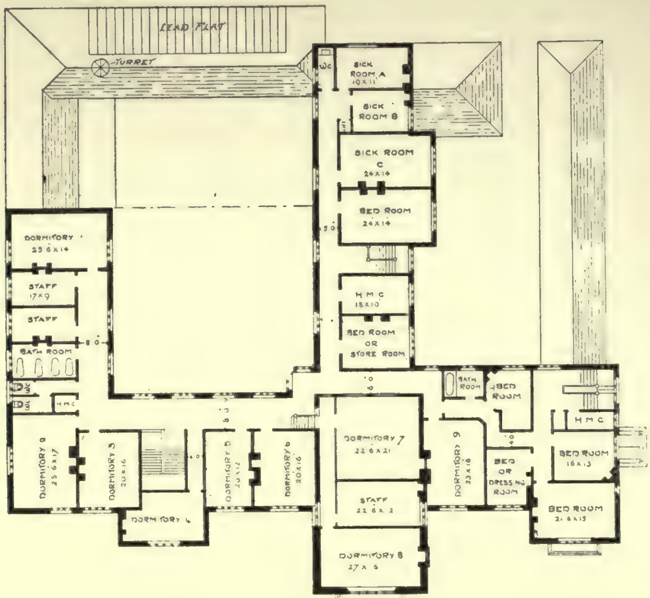


221. BEDALES SCHOOL, PETERSFIELD.

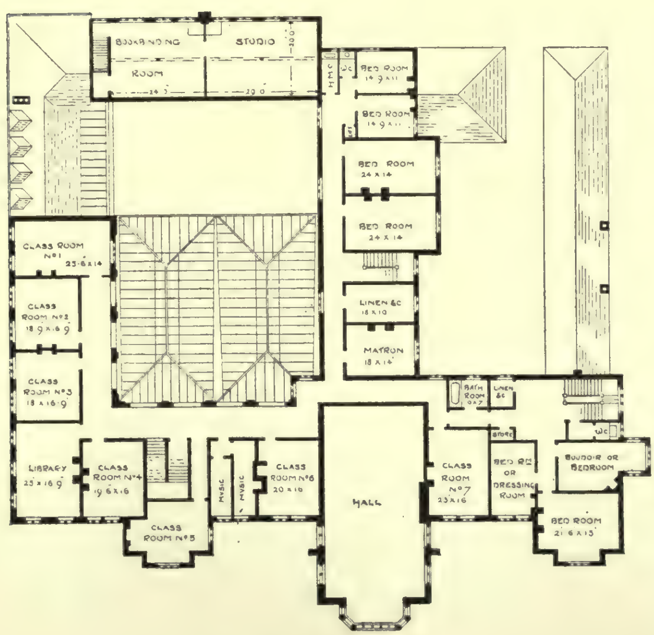
E. Prioleau Warren, Architect.

school is organised on somewhat novel lines, of which a description has been already given.* Though a Private School, it is not a preparatory one in the sense of sending boys on to the Public Schools, the pupils

* See page 27.



Second Floor Plan



First Floor Plan

0 10 20 30 40 50
Scale of feet

222, 223. Bedales School.

remaining in the school until they are ready to go on to College or begin their professional life. The building is the outcome of the co-operation of the Headmaster, Mr Badley, with the architect, Mr Prioleau Warren. It has been very carefully thought out, and shows several features of interest. The main object in its arrangement is to ensure that there should be thorough ventilation and a plentiful supply of fresh air and light. With this object the corridor off which the rooms open on the ground and first floor is open on one side.

The school is for boys and girls. They are educated in the same class-rooms, and are mixed together both for meals and recreation. They sleep in separate buildings, spending the whole day in the main school block. The only influence which this has on the plan is the provision of the girls' cloak-room near the

224. BEDALES SCHOOL.

E. Prioleau Warren, Architect.

To face p. 258.

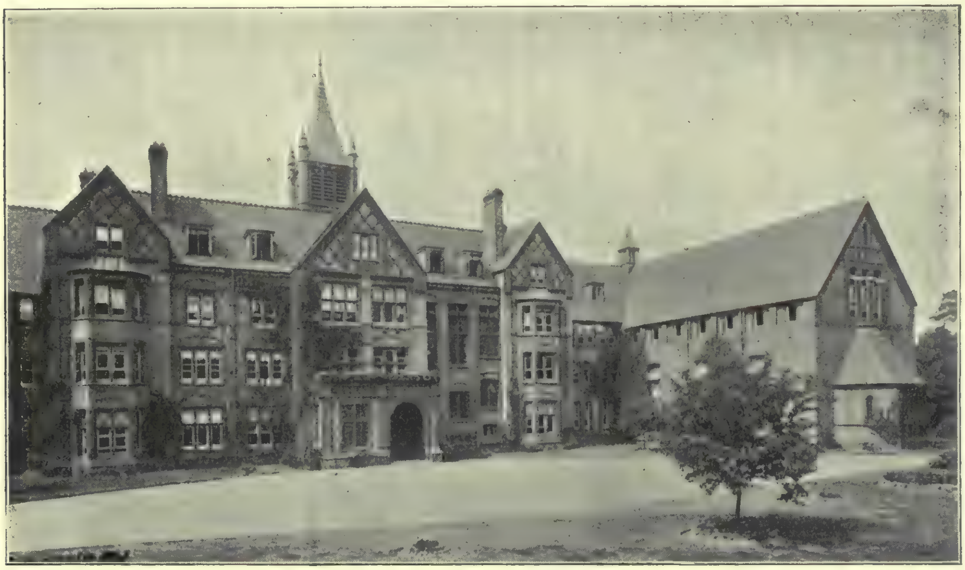
main entrance. The actual school buildings form the three sides of a quadrangle (see Fig. 221), round two sides of which runs a cloister formed of red brick vaulting. This has an extremely pleasant and effective appearance. The central quadrangle is covered for about two-thirds of its length by a glass roof, thus forming a covered playground in wet weather. On the opposite side are two fives courts. The main entrance opens directly into this cloister, leading on the right to the great hall which serves as the living-room of the school as well as for meals. This is a large and lofty room measuring 50 by 27 ft., and is in constant use. The Headmaster's study opens off it. On this side of the quadrangle are found the kitchen and offices, and the Headmaster's private room; on the other, the room for the assistant masters and the dressing-rooms. There is an unusually liberal allowance of these required, as the whole school use them at the same time, it being one of the rules of the school that every boy changes into flannels after lunch and goes out, wet or fine. In order to provide for the great number of damp clothes that result from this system in wet weather, there is in the corner of each dressing-room a clothes shoot in which each boy places his wet things. The shoots end in the drying-room in the basement, placed immediately below.

On the first floor a corridor is carried round above the cloister below, and is open to the air on one side. Off this the class-rooms open. On the floor above are found the dormitories for the boys, arranged to accommodate various numbers from 4 or 5 up to 8 or 10. On each floor the school part is kept separate from the servants' quarters and private part of the house. There is a large carpenter's shop, and over it a room for bookbinding and the studio. Two chemical laboratories, one for chemistry and one for physics, are also provided. A view of the school is shown in Fig. 224.

St Margaret's School, Bushey (Figs. 225-228).—This is an example of a fair-sized Boarding School for girls. This school has boarding accommodation for about 120 girls and 8 teachers, besides the Headmistress's rooms, administrative rooms, &c. The accommodation provides eight class-rooms, all of which, except two which are small and more in the nature of division rooms, are on the ground floor, where are found also the necessary reception-rooms, dining-hall, kitchen, and offices, also a recreation room 39 ft. by 24 ft. 9 in. The sleeping-rooms are arranged partly as open dormitories * and partly as cubicles, the largest number of beds in any room being twenty. There are two

* See page 239.

cubicles provided in each of the open dormitories. The amount of superficial floor space provided is 66 sq. ft. The cubicles, of which there are forty-four, measure 9 by 7 ft. On each floor and in easy reach of each lot of dormitories are arranged the baths, in the proportion of about one to every seven girls. Beyond these, cut off from the main part of the building by an intercepting lobby, the water-closets are arranged in blocks of four, in the proportion of one to every eight boarders. There is a housemaid's closet in each block. The washing arrangements are placed in the dormitories and cubicles, while for day use there is a lavatory downstairs giving one basin to every five girls. Ten practising-rooms

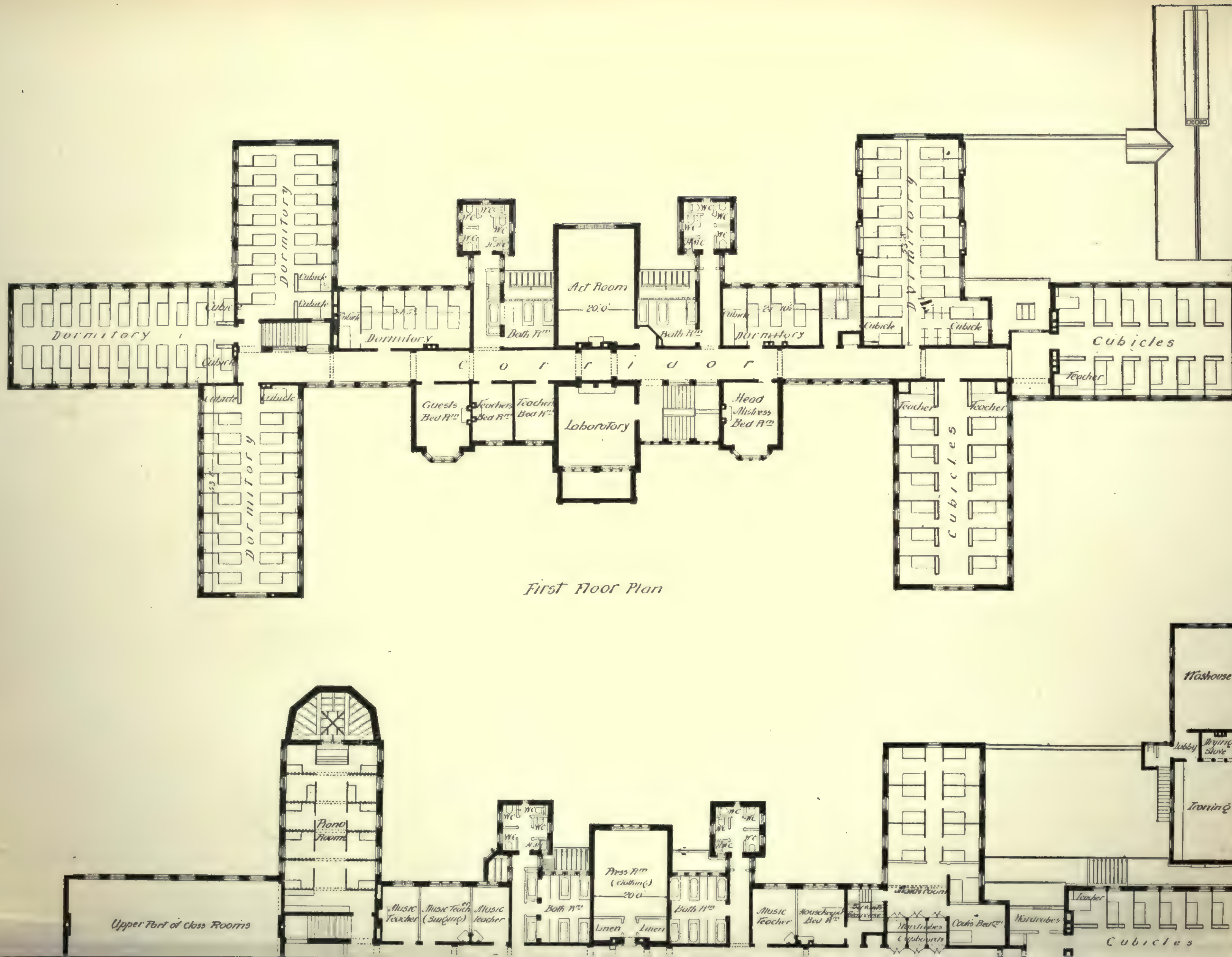


225. ST MARGARET'S SCHOOL FOR GIRLS, BUSHEY. Part of Entrance Front.

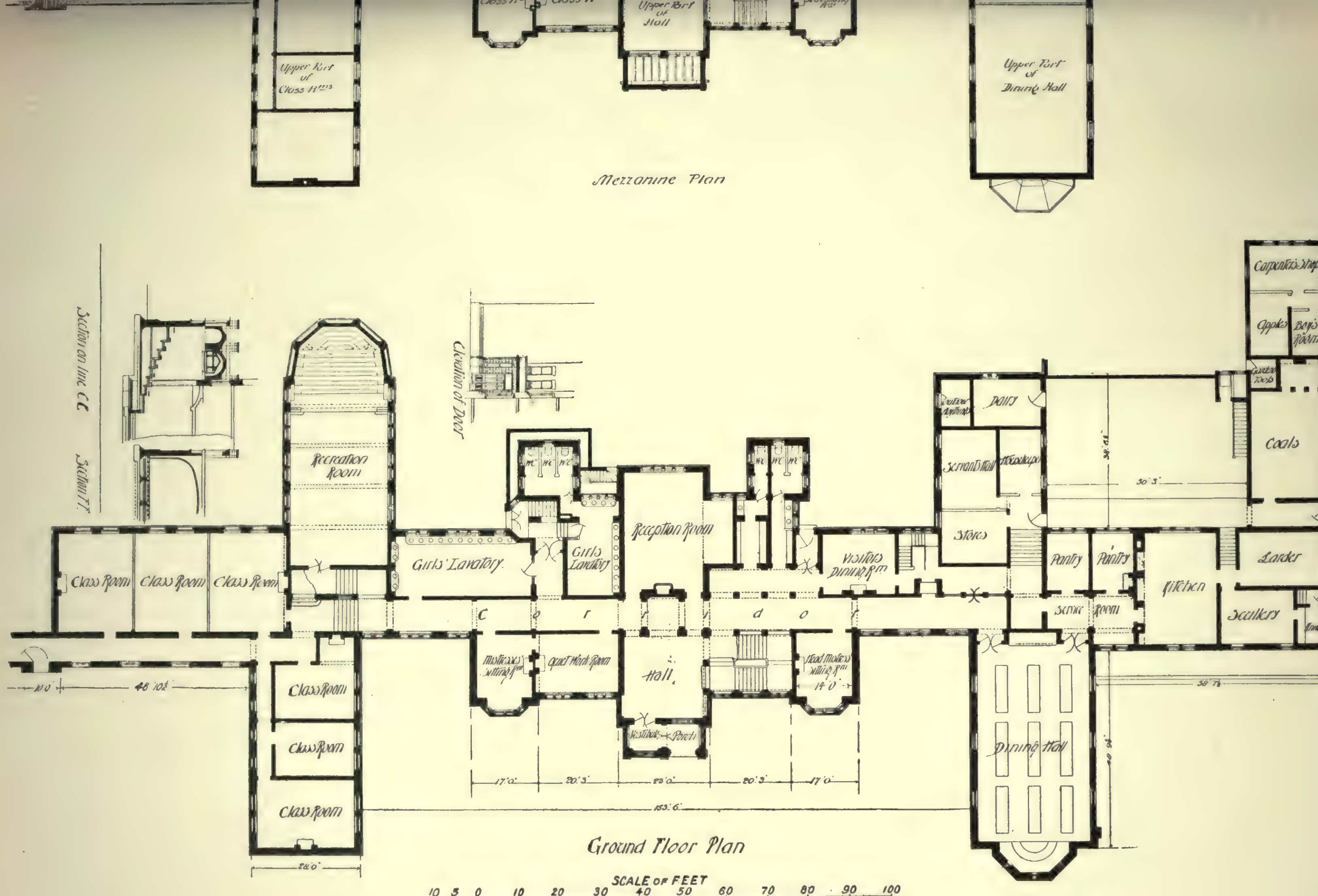
A. Waterhouse & Son, Architects.

with pianos are placed on the mezzanine floor over the recreation room, three rooms being supplied for piano teaching, a room of larger size being provided in addition for singing lessons.

The top floor, with the exception of the studio and chemical laboratory, is given up to the dormitories. These rooms are so arranged in every case that windows can be placed both sides, and thorough ventilation assured. The sleeping accommodation for the servants is arranged by a large room divided into small cubicles opening off a special staircase, with the housekeeper's room close to the entrance. The use of the mezzanine floor is worthy of notice. By this means,



First Floor Plan

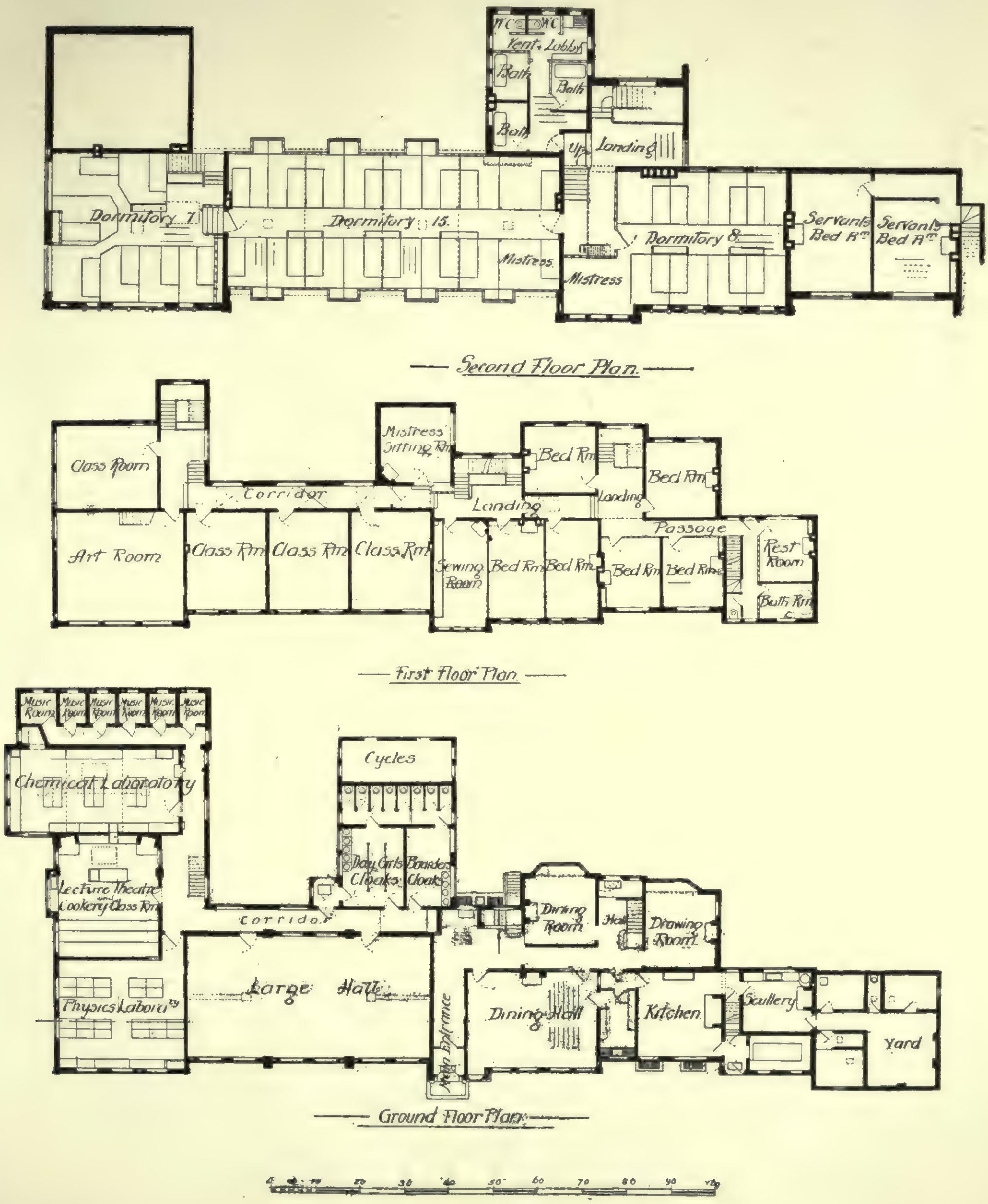


226-228. ST MARGARET'S SCHOOL FOR GIRLS, BUSHEY.

The Clergy Orphan Corporation.

A. Waterhouse & Son, Architects.

Between pp. 260 and 261.



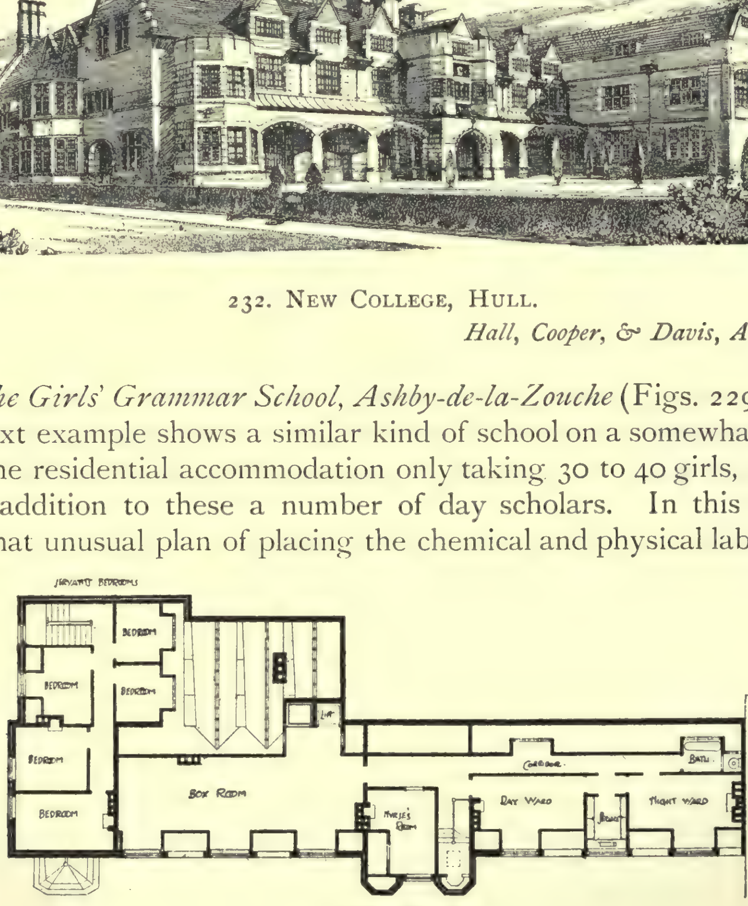
229-231. Day and Boarding School for Girls, Ashby-de-la-Zouche.

Barrowcliffe & Alcock, Architects.

while making it possible to give plenty of height to those rooms on the ground floor where it is necessary, such as the dining-hall, recreation rooms, and the class-rooms, full advantage is taken of the space which is obtained by grouping on this floor all the rooms in which it is not essential that there should be much height.

232. New College, Hull.
Hall, Cooper, & Davis, Architects.

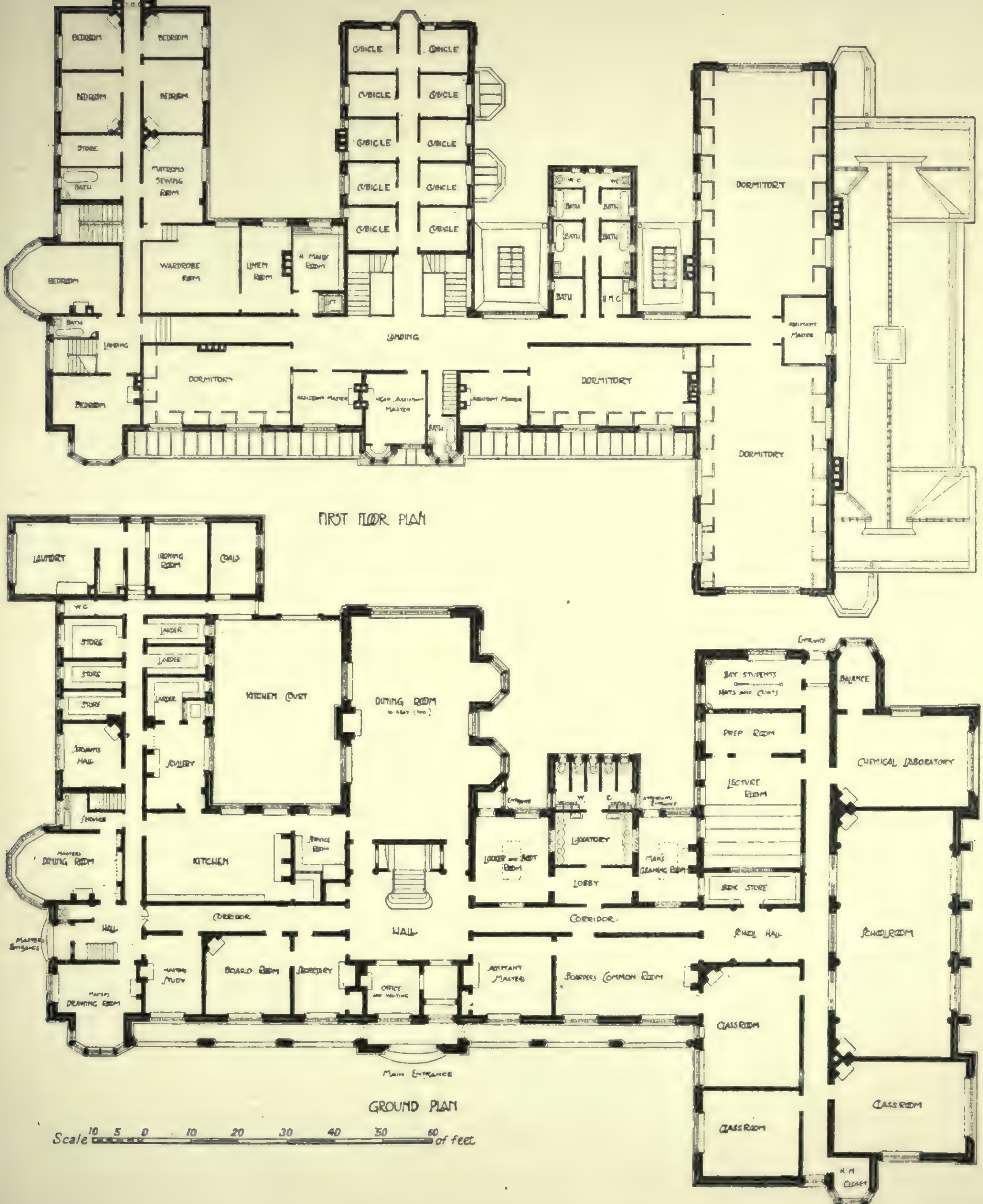
The Girls' Grammar School, Ashby-de-la-Zouche (Figs. 229-231).—The next example shows a similar kind of school on a somewhat smaller scale, the residential accommodation only taking 30 to 40 girls, but there are in addition to these a number of day scholars. In this plan the somewhat unusual plan of placing the chemical and physical laboratories



233. New College, Hull.

with the lecture-room on the ground floor has been adopted, the class-rooms being placed on the first floor. The dormitories are fitted with cubicles.

New College, Hull.—This building (Figs. 232-235) combines in one



234, 235. New College, Hull.

Hall, Cooper, & Davis, Architects.

block a master's house and boarding arrangements for some 60 boys in addition to the educational accommodation. The building is planned so that the master's part of the house is separated from that of the boys, the kitchen being common to both parts. On the east side of the main entrance are placed the assistant masters' room and the boarders' common room, these rooms having a southern aspect. The latter room measures 29 by 17 ft., and is fitted with bookshelves, &c., so arranged that in addition to serving as a recreation room it can be used for working in during the evening instead of the large schoolroom. To the north of the entrance is the large dining-room. This is intended to provide room for 100 boys, and has two bay windows overlooking the sea. The large schoolroom measures 52 by 24 ft. It has a fireplace at each end, in addition to which are supplied hot-water radiators. There is a locker-room with a locker for each boy with a separate entrance from the playground. On the first floor are two dormitories containing seventeen beds, so arranged that one master can overlook both. Two smaller rooms containing nine beds are also so arranged that supervision can be maintained. It will be noticed that the plan of having a small part screened off at the head of each bed described above* has been adopted. Ten cubicles measuring 9 by 10 ft. are also provided. On the top floor, in addition to the servants' room and a large box-room, there is arranged a completely isolated sick ward, consisting of a nurse's room, a day ward and a night ward, bath-room and service room. The box-room has a lift coming directly from the entrance hall. A view of the exterior of the building is shown in Fig. 232, the materials being local red brick with stone dressings.

The Knaresborough Grammar School (Figs. 236, 237).—This plan shows a somewhat curiously shaped building. The sleeping accommodation is entirely arranged in cubicles 7 ft. 6 in. by 6 ft., two assistant masters' rooms being arranged to command the view of the corridors between the cubicles. On the ground floor are arranged the class-rooms, chemical laboratories, and a large manual instruction room. The residential house for the master is placed at one end, and is cut off from the school part of the buildings.

Bridlington Grammar School.—Figs. 238-240 show this school, a compact and well-arranged building, having accommodation for some 60 to 70 day boys and 25 boarders, as shown on the plan. The building has, however, been recently added to, so as to complete the original scheme, which makes the hall the central feature of the buildings.

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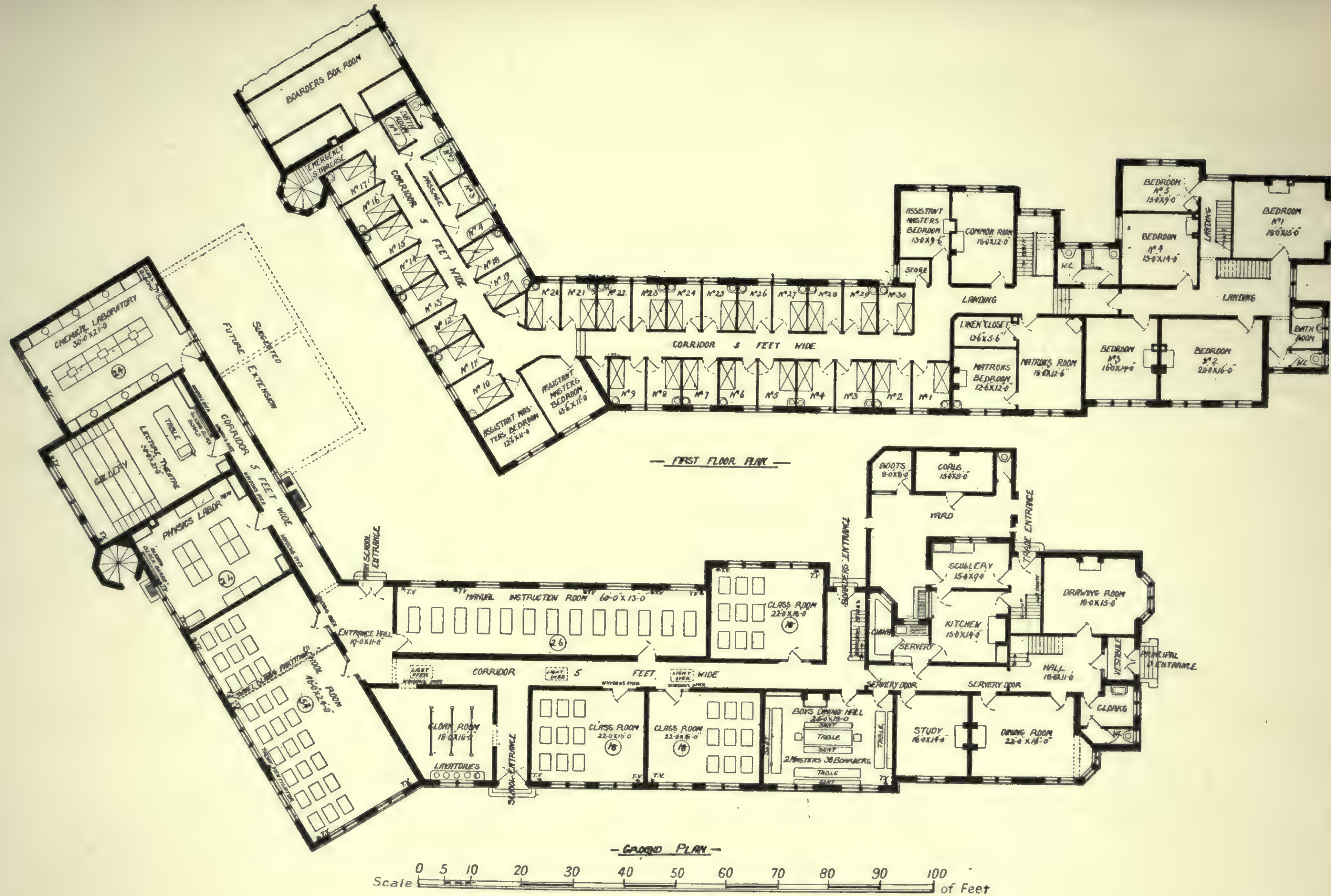
* See page 239.



236, 237. THE KNARESBOROUGH GRAMMAR SCHOOL.

Barrowcliffe & Alcock, Architects.

238, 239. THE BRIDLINGTON GRAMMAR SCHOOL.

Botterill, Son, & Bilson, Architects.

This is shown in the exterior (Fig. 240). The additional buildings comprise further class-room accommodation, with science laboratories and lecture-room. The class-rooms measure 22 by 20 ft., and as it is not intended to have classes of more than 24 at the most, ample floor space is provided. The dormitories are placed over the class-rooms on the first floor. The basins for washing are not placed in

240. THE BRIDLINGTON GRAMMAR SCHOOL.

Botterill, Son, & Bilson, Architects.

the dormitories, but in special lavatories. The grounds of the school comprise some 30 acres.

For further examples of Boarding Schools and Preparatory Schools, see—

The Builder.—42, 23, 100, 293, 325; 67, 25, 59, 100; 68, 376; 69, 314; 70, 472; 74, 280; 81, 214.

The Building News.—41, 296; 53, 320; 59, 320; 62, 203; 64, 767; 66, 849, 888; 67, 8, 40, 72, 749; 73, 221, 581; 76, 672.

The British Architect.—49, 166; 50, 200; 51, 348.

Chapter XV.

BOARDING SCHOOLS

(Continued).

Infirmaries and Sanatoria—Amount of Accommodation necessary for Infectious and non-Infectious Illnesses—**Sanatoria**—Rooms required for, and their Arrangement—Example of—**Infirmaries**—Arrangement and Example—**Provision for Games**—Amount of Space to be provided—Cricket Grounds—Table showing Area required for different Games—Fives Courts, Description and Illustration of—**Gymnasia**—Requirements of, and Size required for Schools of different numbers—Material for Floor—Apparatus required.

INFIRMARIES AND SANATORIA.

In Boarding Schools, especially those in which the numbers are large, the suitable provision to be made for illness becomes a question of great importance. The cases arising fall generally under three heads—Infectious diseases, accidents and severe illnesses of a non-infectious nature, and slight ailments. All that is required for the last class can be managed by having in the boarding-houses one or two quiet rooms away from the dormitories and general rooms of the house.* For the other classes it is generally demanded that every school should have two separate buildings—an infirmary for accidents and non-infectious cases, and a sanatorium where cases of infectious diseases can be effectually isolated. This of course entails a double staff, and the maintenance of two establishments, and except in the case of large schools is often found too costly. Dr Clement Dukes † maintains that, provided proper care be taken in the planning, and sufficient precautions maintained in its use, that one building can be made to serve the two purposes. But there is no question as to the advantages of having a separate building for infectious cases only.

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* In the new buildings for Christ's Hospital, Horsham, there is no provision for any sickness in the boarding houses. Any boy who is ailing in any way is sent at once to the infirmary close to the school.

† "Health at School." 1894.

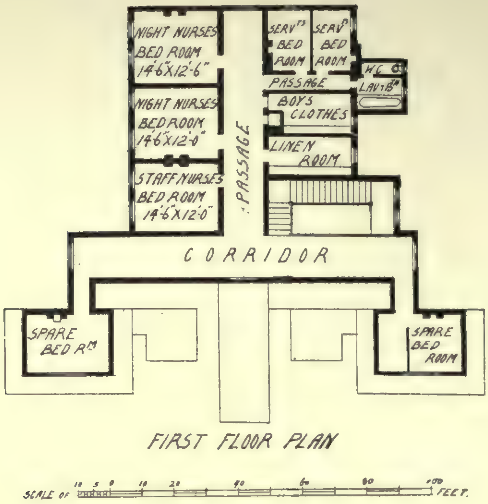
Amount of Accommodation necessary.—This varies slightly according to the ages of the pupils. The Council of the Medical Officers of Schools Association * give the following suggestions as to the numbers of beds to be provided. In schools where the average age is over fifteen years, for non-infectious cases 6 to 7 per cent., for infectious diseases 20 per cent. This is on the supposition that cases of measles are treated in the sanatorium. If not, 10 per cent. should be deducted. These figures, which make a total of 25 to 27 per cent. of beds to be provided, would mean in the case of a large school a very large outlay and heavy expense in maintenance. In the case of a bad outbreak of infectious disease in a school it is probable that even 20 per cent. would be unequal to the strain, and that some emergency arrangements would have to be made, while for ordinary school life the provision would be far in excess of the requirements. Dr Dukes in his book on School Hygiene, when discussing sanatoria, reckons that when children are congregated in large numbers there should be provided 20 per cent. where the average age is under thirteen, and 15 per cent. where over thirteen; † but a less number will be required where the school is split up into separate boarding houses.

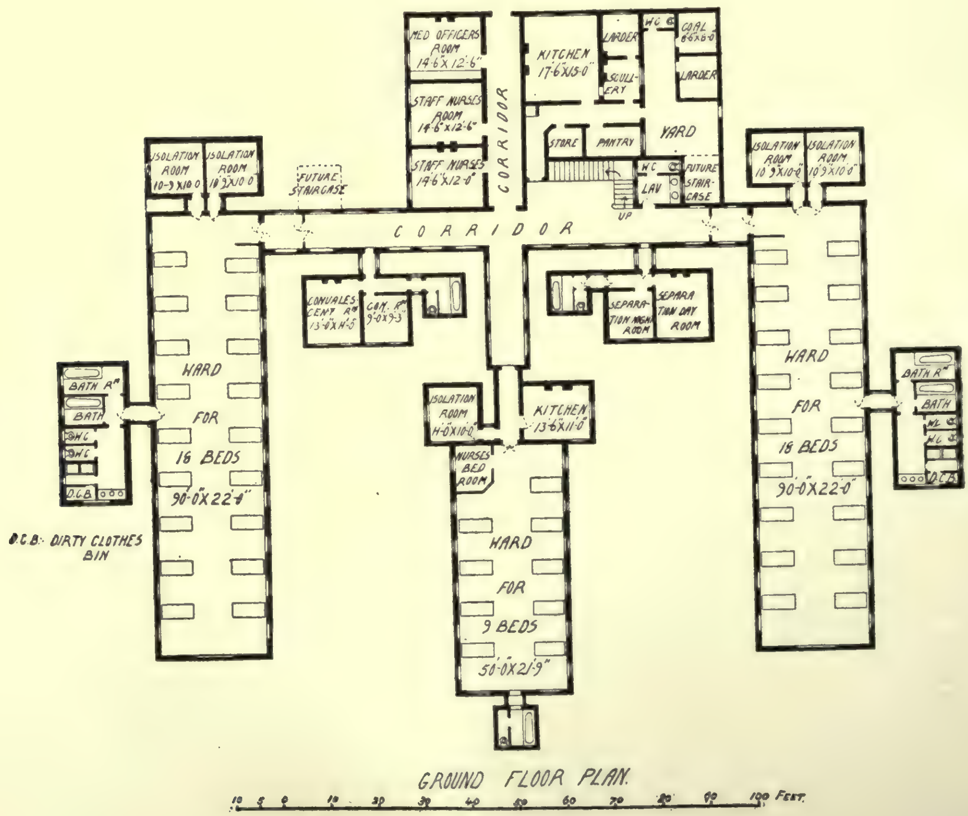
This number would include both classes of cases, infectious and ordinary complaints. On the whole it will generally be found that a provision of ten beds for every hundred boarders will, where the school is divided into separate boarding houses, be a sufficient provision. This is the number that has been adopted in some recently erected schools. For the infirmary, where there is no arrangement of sick rooms in the boarding houses, there should be a provision of 5 per cent. It is, however, more usual to have one or two rooms arranged in the houses where trifling ailments can be treated, or isolated if an infectious complaint is suspected. In this case less provision is required in the infirmary.

Sanatorium.—The accommodation necessary will comprise, in the Administration Department, medical officer's room, matron's room, kitchen, offices, linen store, servants' rooms and store-rooms, and extra

* Treatise on Hygiene and Public Health, Stevenson and Murphy, vol. i., p. 756. 1892.

† Owing to the great increase of sanitary knowledge and methods of protection against infection, a very large proportion of children come to school without having had the usual diseases incident to childhood, so that when an epidemic does break out, it is more likely to spread now than in the old days, where a large proportion of the school would already have had the disease.





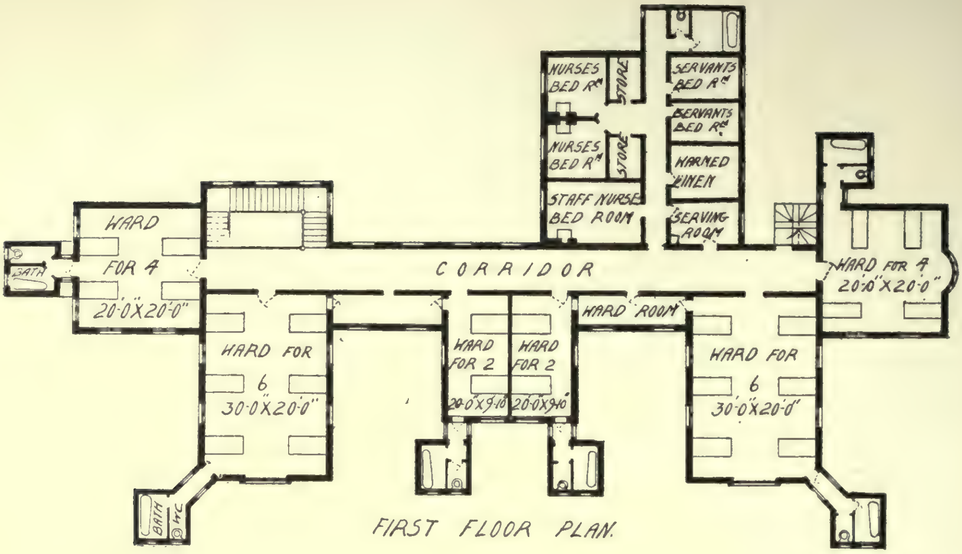
241, 242. A SCHOOL SANATORIUM.

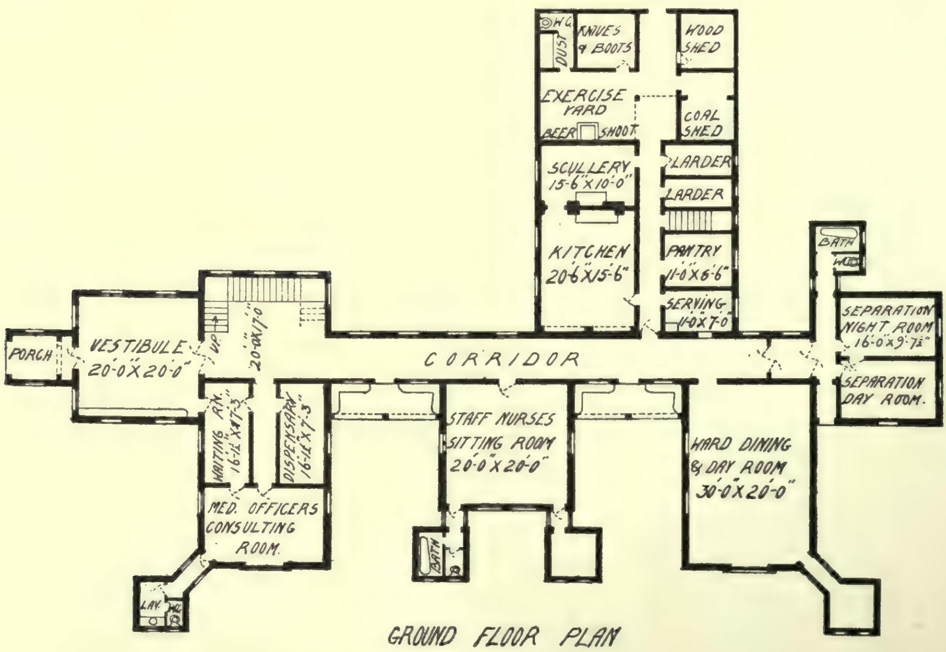
B. Champneys, Architect.

bedrooms in case of additional nurses being required. At least two general wards, in case of there being two infectious diseases in the school at the same time; a certain number of single-bedded isolation rooms; a convalescent room, and necessary accommodation for the nurses on the staff. Bath-rooms and lavatories must be arranged in connection with the different wards and rooms—of course effectually isolated. It should be remembered that some arrangement should be made so that a boy leaving the sanatorium to return to the school may be able, after his final disinfecting bath, to get out without entering any part of the building again. Casement windows coming down to the ground in the bath-room can be made to answer this purpose. A disinfecting apparatus should be found in every school sanatorium. A plan of a school sanatorium is shown in Figs. 241 and 242 from a design by Mr Basil Champneys. This is intended for a school of 500. It will accommodate 50 boys in three wards, and five single isolation rooms. Two of the wards contain eighteen beds. This is rather a larger number than is considered advisable by many authorities. They measure 90 by 22 ft., giving a floor space of 110 sq. ft. Each ward is arranged so that it can be isolated from the rest of the building.

Infirmaries.—The school infirmary need not be placed at any great distance from the rest of the school buildings, provided that it is well out of the noise and bustle. A number of small rooms are required here rather than large wards, in order that there may be ample means of classifying diseases, and keeping separate any boys suffering from contagious diseases such as ringworm. A consulting room must be supplied for the medical officer, so that the boys can come here, when suffering from slight ailments, for advice. A dispensary is usually provided as well. Figs. 243 and 244, of which Mr Champneys is likewise the architect, show a method of arranging a school infirmary. It has accommodation for 24 patients, arranged in six different wards, taking from two to six beds.

It has not been possible to go into detail as to the construction and fittings of sanatoriums and infirmaries, as this would involve questions which lie far outside a book of this sort, and which properly come under the head of hospital construction. At the same time, as such buildings form so necessary a part of a school, and as school architects are usually called upon to design them, it was considered as well to include plans of each, with a few general remarks.





243, 244. A SCHOOL INFIRMARY.

B. Champneys, Architect.

PROVISION FOR GAMES.

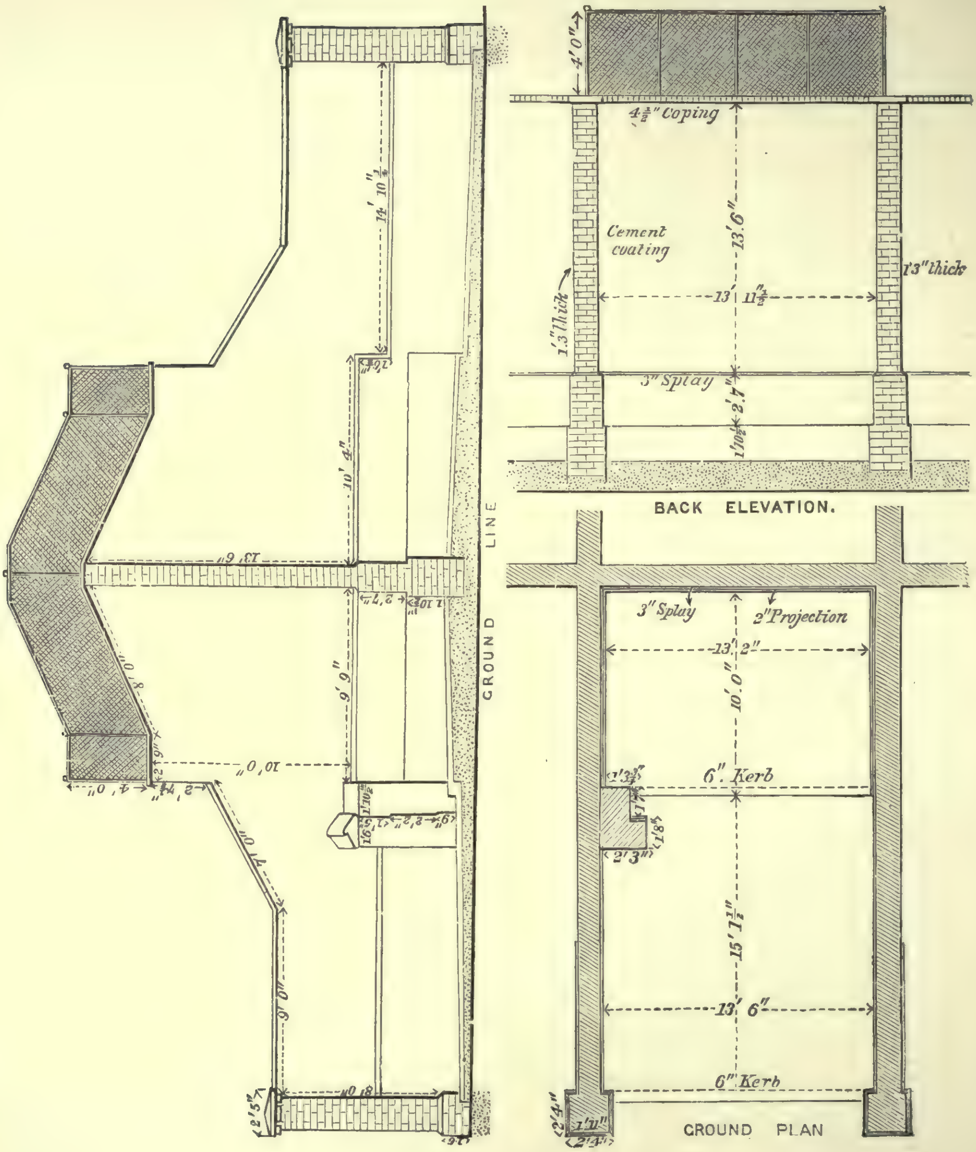
In estimating the area required for the site of a school, the extent of the provision that is to be made for games has to be settled. In Boarding Schools, where the whole of the recreation time of the pupils has to be provided for, a large extent of ground is necessary. In Day Schools it is not possible to put the same pressure upon boys and girls not naturally fond of games, and who prefer to be at home rather than to come back to the school and play. In many schools games are either compulsory by the rules of the school, or practically made so by the boys themselves. In any case there should be ample provision made in the way of space. In a large school there will be the regular playing fields for cricket, football, &c.; in addition to this there is required a considerable area of playground in and round the school buildings. The amount of space devoted to this should be larger if, as is sometimes the case, the playing fields are some little way off.

It is hardly possible that any general rule could be made as to the area necessary, it comes practically to as much as can be got, the resources of the school settling the limit, as the cost of keeping a large area in order is considerable. From 15 to 20 acres for every hundred boys will probably supply sufficient room for playing fields for all games, since a large part of the cricket ground is used for football or other games in the winter. There is appended a table giving the measurements required for different games. For cricket of course there are no exact limits, but for a single ground from 4 to 8 acres will give the limits of a small and a large ground, but at school the cricket grounds are not divided as a rule into separate grounds. Generally speaking, there are one or more large playing fields, and while one piece, probably in the centre, may be kept sacred for matches and the play of the senior boys, the other games are played all over the ground, the pitches being placed at sufficient distances apart to avoid, if possible, any chance of danger.

TABLE SHOWING SPACE REQUIRED FOR DIFFERENT GAMES.

Cricket - -	Say 8 acres for each 100 boys.
Football (Rugby)* -	110 by 75 yds.
Football (Association)	Maximum, 200 by 100 yds.; minimum, 100 by 50 yds.
Hockey - -	100 by 50 yds.

* This is the limit size.

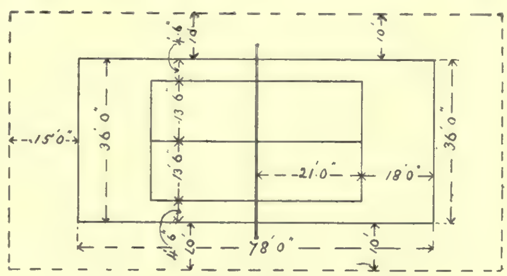


245-247. A Fives Court.

From the "Badminton Library."

Lacrosse	Length between goal posts—maximum, 150 yds.; minimum, 100 yds. Boundaries as arranged.
Rounders	Diameter of circle posts, 25 to 30 yds.; ground required, 1 to 2 acres.
Lawn tennis	With sufficient margin (see Fig. 248), 108 by 56 ft.
Croquet	30 by 40 yds.
Basket ball	100 by 50 ft.
Badminton	40 by 20 ft.

Fives Courts.—As fives courts are so common and so excellent an addition to school buildings, and as the form of the court, at least that form of it known as the Eton Court, is a rather complicated building, it has been thought as well to give details of its construction. Figs. 245-247, reproduced by permission from the "Badminton Library," show the different parts of an Eton Court. If this form of court is adopted, it is essential that it should be accurately built to conform to this, the usual standard. As regards the number of courts that should be supplied, it will be found that if the game is at all popular, two or three for every hundred boys will be required.



248. A Lawn Tennis Court.

The Rugby Fives Court is similar, but with all projections, buttresses, steps, &c., omitted. In many cases a back wall is added. In this case the court will serve equally well for the game known as squash racquets. Fives courts now form a fairly common feature in Girls' Schools, the Rugby form being usually adopted. Fives courts have been added to several schools belonging to the Girls' Public Day School Company, and have proved very popular. It is necessary now to supply hardly less room for play in Girls' Schools than in the case of those for boys, for though football is not played, hockey, which is a popular and widespread game, requires as much space. Cricket, too, is being successfully tried in many schools for girls.*

* See Special Reports, vol. ii.

GYMNASIA.

A gymnasium is usually found in Secondary Boarding Schools, and in most cases in Day Schools ; but it is hardly regarded with the same importance in this country as in Germany, where in every school of whatever grade there is invariably a well-equipped gymnasium. It is undoubtedly of more importance in that country than here, where games, at all events in the Higher Schools, play so important a part. A gymnasium is sometimes placed in the basement in Elementary Schools (see for example Fig. 296, p. 337), but the position is not a very satisfactory one, and is forbidden by the Prussian regulations as to school buildings. German writers strongly recommend a separate one-storied building connected with the school by a covered way.

Size required.—There should be plenty of room provided to allow of a considerable amount of movement. An allowance of 20 to 25 sq. ft. per head of the largest number that are likely to be using it at once is not too large an allowance. The following dimensions are given by Hittenkofer* for pupils above the Elementary School age. These measurements are the same as those laid down by the Prussian regulations in 1870.

For 50 - - - -	31 by 51 ft. 6 in.
For 75 - - - -	36 by 67 ft.
For 100 - - - -	41 ft. 3 in. by 72 ft.

These are of course fairly liberal measurements, and in the large town schools in Germany the gymnasia measure from 65 to 80 ft. in length, and from 30 to 40 ft. in breadth, giving an allowance of 25 to 30 sq. ft. per head. In Würtemberg only 20 sq. ft. is required.†

It is usual to build gymnasia of one storey only with an open roof, to the timbers of which the appliances can be hung. The Munich building instructions suggest a building with two floors, the lower room being fitted with all usual fixed apparatus, while the upper room of the same size would be kept clear for marching and other exercises. In the large German Schools it is very common to supply a double gymnasium (see Fig. 146) for the two sexes, in order to get the requisite amount of physical training into the ordinary school hours. In such cases it is recommended that the dividing wall should be movable.

The fixed apparatus is placed near the walls or grouped in order

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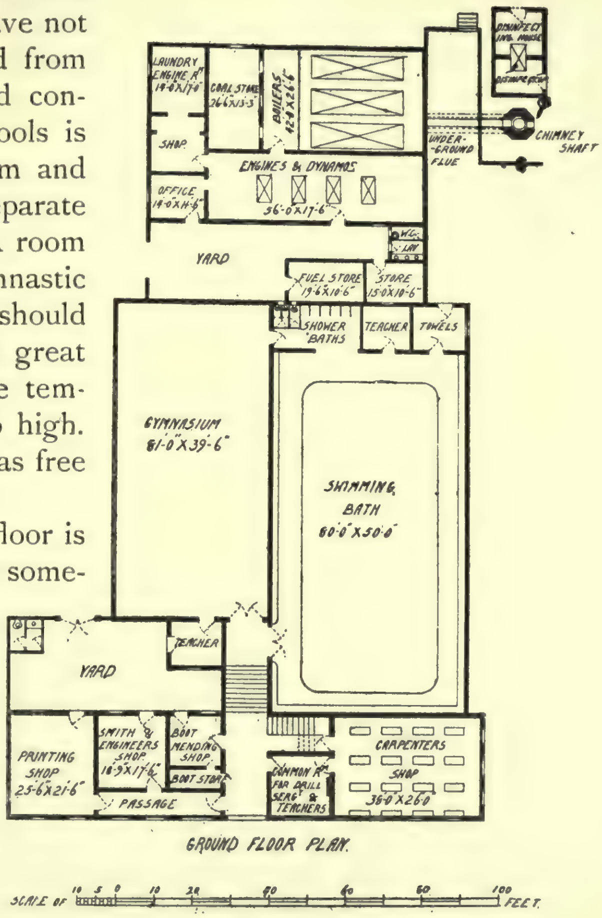
* Der Schulhausbau. † Schulhygiene, Baginsky.

to allow as large a space in the middle as possible. In Germany it is sometimes customary to allow a free space 7 or 8 ft. wide all round the room to allow of marching. Some convenience should be arranged either in a small vestibule or otherwise, so that pupils can change into their gymnastic shoes without bringing dust into the building.

Changing rooms, lavatories, &c., ought to be supplied with access from the gymnasium so that those using the building have not to go outside when heated from exercise. A common and convenient plan in large schools is to combine the gymnasium and swimming baths in a separate building (see Fig. 249). A room is required for the gymnastic instructor. The building should of course be warmed, but great care taken to see that the temperature does not rise too high. The ventilation should be as free as possible.

The material for the floor is of importance. It should be something that will neither wear slippery, or from which dust can be easily kicked off. It should not be too hard and solid, but should be to some extent elastic, and should have sufficient resonance to respond to a sharp tap of the foot. If of wood, it must be secure against any tendency to come off in splinters. Cement and asphalte have most of the above objections. Where expense has not to be considered, an excellent floor can be made of narrow oak boards tongued together, with the joints caulked. Well-laid oak parquet is good, but lacks the resilience of the boards. Where boards are used care should be exercised to see that all the nailing is properly hidden.

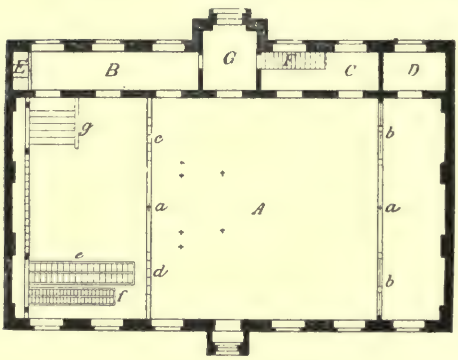


249. A Gymnasium and Swimming Bath.
B. Champneys, Architect.

One of the most difficult things to provide against is the dust. Of course the better the ventilation, the less it will be felt. In order to prevent the dust accumulating too much, it is recommended that the floor and apparatus should be wiped with a damp cloth daily. The mattresses used for jumping are of course a fruitful source of dust. These ought to be covered with leather on both sides, and frequently beaten in the open air. They should not be dragged about the floor. Cocoa-nut matting especially holds the dust. There are various methods used for quickly laying the dust that has been stirred up, by means of hand instruments that throw a fine spray of liquid.

Apparatus.—The appliances for which provision has to be made are :—

Parallel Bars.—Usually about 9 ft. long and 20 in. apart. They are often made adjustable as to height for school use. For adults they are generally about 4 ft. from the ground.



250. A Gymnasium.

A. Gymnasium. *B*. Cloak-room. *C*. Apparatus. *D*. Instructor's Room. *E*. Offices. *G*. Entrance. *a, a*. Running Course. *b, b*. Fixed Horizontal Bars. *c*. Trapeze. *d*. Rings. *e*. Horizontal Ladder. *f*. Sloping Ladder. *g*. Climbing Poles.

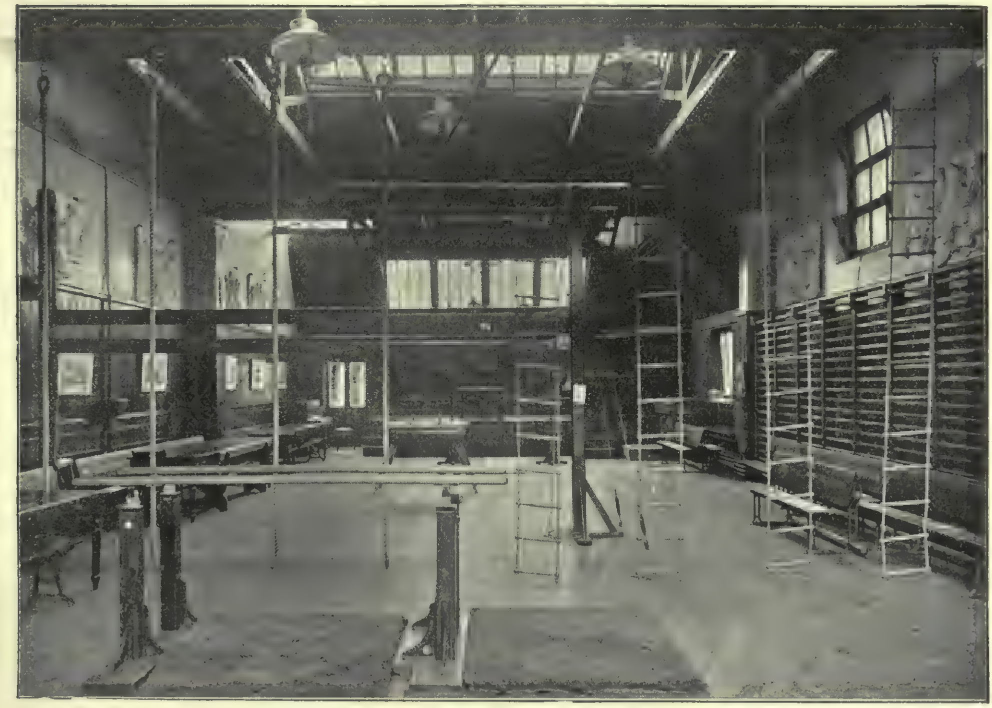
Horizontal Bars.—These are adjustable to heights varying from 3 to 7 ft. from the ground. It is often convenient to have them made so as to be easily movable, small plates being fixed in the floor to which the stays can be fastened.

Vaulting Horse with a Spring Board and Mattresses.—Bridge or horizontal ladders suspended 6 or 7 ft. from the floor. Hand rings having a diameter of 5 to 9 in., hung in pairs about 18 in. apart, at a height of 3 ft. 6 in. from the floor. These rings are also used hung singly at a distance of some 5 or 6 ft. down one side of the gymnasium. Swinging trapezes, the height and distance from the floor depending upon the age and attainments of the pupils. There are of course the various appliances for climbing, inclined ladders and ladder planks, ropes both with and without knots. A piece of apparatus generally found in gymnasiums attached to Girls' Schools is the beam. This is a stout piece of wood fixed horizontally between the supports placed some 8 or 10 ft. apart. The horizontal part is made adjustable to height. It is not uncommon to find one of the upright posts for this fixed to the

wall while the other is arranged so that it can be easily moved and taken away when not required.

In Fig. 250 is shown the plan of a Berlin * gymnasium upon which the position of the apparatus is marked. An interior view of a gymnasium in a large Girls' School is given in Fig. 251.

* Schulhygiene, Baginsky. 1898.



251. THE GYMNASIUM, KENSINGTON HIGH SCHOOL.

The Girls' Public Day School Company.

Chapter XVI.

ALTERATIONS AND ADDITIONS, ETC.

Alterations and Additions to existing Buildings — Conversion of Dwelling-houses for School Purposes—Questions of Accommodation—Warming and Lighting—Some Notes upon the Cost of Schools—The Care of School Buildings.

The question of adding accommodation to an already existing building, or the alteration of some antiquated arrangement in order to conform with modern requirements, is one which is of course continually arising in connection with school work. But while it is one full of interest, and one which offers full scope to all the skill and ingenuity the architect may possess, it is hardly one upon which it is possible to find any definite rules. The additional accommodation required has generally been fully determined by experience. The question to be decided is the most economical and convenient method of getting what is wanted. This is of course so completely dependent upon the buildings already existing, that it seems doubtful whether there would be any real utility in giving examples of such alterations. It need, however, be scarcely pointed out that it is in this sort of work that a knowledge of school routine and work is of great value, since it is often by changing the purposes of some rooms, and by altering the sizes and positions of others, that the additional accommodation is partly gained. The practical effect of such changes can hardly be gauged without a knowledge of the working of the school. The architect has, again, to steer a delicate course between the idea of what is wanted as seen by the principal of the school, and what is regarded as absolutely necessary by the governing body of the school, who have to keep an eye on the financial side of the question, and who may not take quite so optimistic a view of probabilities of increase in numbers.

The disadvantages arising from the use as a school of a building originally intended for a dwelling-house are many and obvious. The rooms seldom correspond to the required sizes for the classes, and so involve classification of the forms rather by the capacity of the rooms than by the attainments of the scholars.. The staircases and

passages are as a rule awkward and impossible to supervise, and the rooms difficult to ventilate. The use of houses for this purpose is, however, at times a necessary expedient, either as a temporary measure during the rebuilding of a school, or in order to test the advisability of building a school in a particular neighbourhood, if not as a permanent arrangement.

The first question that arises, after the preliminary point as to whether there are any objections on the part of the landlord or otherwise to carrying on a school in the building has been settled, is with regard to the number of pupils that can be put into the house. This is by no means an easy matter to calculate. To take the dimensions of the different rooms, and after reckoning the amount of floor area to divide by the number of square feet to be allowed to each pupil, will not give an accurate idea of the number that can be properly placed in each room. First of all, it is unlikely that the lighting will be sufficiently distributed to make it possible to place desks all over the room. The position of the fireplace again makes a considerable difference. If placed, as is usual, in the middle of one wall, a certain amount of space is wasted, unless the position of the windows will allow of the desks being placed to face the fire. Unless the door into the room happens to come near the teacher's end of the room, a wide gangway has to be left for entrance and exit. The possibility of providing sufficient cloak-room and lavatory accommodation is one of the important points in forming an opinion as to the suitability of a house for the purpose of a school. This is of especial importance in the case of Girls' Schools, where a large provision of cloak-rooms is necessary.* If the house has a large and fairly high basement, it is usually convenient to provide the cloak-rooms there. Otherwise the difficulty may be got over by scattering the cloak-rooms about the building, utilising dressing or other small rooms unsuitable for any other purpose. The floors of course require careful looking to, as they may not be strong enough to stand the movements of large numbers. The stairs too may have to be strengthened, and care taken to see that the banisters are capable of withstanding the sudden strain of a number leaning on them at once.

It is unusual to find any provision for the ventilation or the admission of air in a private house, so that it becomes necessary to put in a number of inlet ventilators such as the Sherringham. Especially is this the case when the open fires are used, for unless

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* See page 155.

some precautions are taken, there are sure to be complaints of the draught from the door to the fire, from those sitting in a line between them. In the case of sash windows the ventilation can of course often be obtained by the use of Hincke Bird's arrangement for obtaining an inlet of air between the sashes (see Fig. 379). In case of rooms with windows coming down to the floor, such as French casement windows, it will add much to the comfort of the pupils to board up the lower part to a height of 3 ft. or 3 ft. 6 in., not only to prevent the reflections from the floor if that happens to be polished, but to guard against the strong and unpleasant draughts that are sure to arise in cold weather.

It will generally be necessary to supply additional warming. The fireplaces, which are quite sufficient for a dwelling-house in which the few people who occupy the room can group themselves round it, are not usually capable of properly warming the farther corners of the room. The larger rooms and those on the north side of the house will in every case have to be provided with some form of additional heating. It will usually be found that this can be most conveniently done by the use of the small pipe medium pressure apparatus. The pipes are small and can be taken almost anywhere, and can be arranged with less damage to the building, an important consideration if reinstatement has to be ultimately undertaken. The installation of the hot-water apparatus, the expense of which is not very great, will enable the cloak-rooms to be kept warm and the clothes dried. Also the hall and passages can be kept up to a fair degree of warmth, and so add very materially to the comfort and pleasantness of the school.

The want of good lighting in the rooms is one of the strongest objections to the use of an ordinary dwelling-house as a school, for although the rooms may appear bright and well lit, it will probably be found that when the desks come to be put in, there are certain places in the room where the light is by no means sufficient. If the numbers can be limited so that the desks can all be grouped in the part of the room where the light is good, the objection will not of course be felt. This is not often possible in practice, it being usually found necessary to squeeze desks into every available corner. Unluckily the light can seldom be improved without large and expensive alterations. Verandahs and other obstructions to the light, such as boxes to hold venetian or sun blinds, should, if not absolutely necessary, be cleared away. The few inches so gained at the top of a window make a great difference in the light. Overhanging branches of trees should if possible be removed. Glass panels in the upper part of doors may assist in lighting corners and passages inside the building, which,

though light enough for an ordinary house, are often too dark for school purposes.

It is unusual to find a house with any room of sufficient size to serve as an assembly hall, though it may happen, if the house is a large one, there may be a music-room or ball-room which will answer the purpose. In cases where the house is taken to be used permanently as a school, it will probably be found best to build on an assembly hall, in which case it is generally possible to combine with it a few class-rooms, cloak-rooms, and lavatories. Great care has to be exercised in providing a convenient access. This often takes the form of a corridor, since the erection of such a building close to the original house may block too many windows. Such corridors should be well and carefully heated, so that they may, if of sufficient width, say 9 or 10 ft., be made of considerable use, benches for wood-carving, museum cases, &c., being placed in them. In cases where the additional buildings can be added directly to the existing house, it is of considerable importance that there should be a way through made on the upper floor, if the additions consist of more than one floor. Neglect of this precaution involves a long journey when it is necessary to get from the top of one building to the upper floors of the adjoining house. Where structural alterations are undertaken it is worth bearing in mind the possibility of taking away a floor; for instance, on a bedroom floor, which, having nothing but attics over, is itself too low to be used for school work, by taking out the attic floor and putting a skylight in the roof, an excellent room can sometimes be obtained for a studio or science room. The removal of the joists cannot, however, always be done with impunity in an old house. It sometimes happens that a house may be found that offers exceptional facilities for conversion into a school, and that by fairly extensive and well-planned additions, a commodious and satisfactory school building can be obtained. In one case of this kind in which a Girls' School had been very successfully adapted from a large private house, the Headmistress maintained that such a building was actually preferable to a specially-built school, on the grounds of its home-like appearance, and the absence of the bareness and monotony so often found in school buildings. This suggestion would, however, be better met by a more careful and artistic treatment of the design of new buildings, a point to which attention has already been drawn,* than by taking and adapting an old house. While there are still many schools carried on in ordinary

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* See page 53.

dwelling-houses converted to the purpose, it is not a method that is likely to find much favour in the future. The high standards demanded now on questions affecting the health of scholars, will render it necessary that all schools of any size should be carried on in buildings specially constructed and properly fitted for educational work.

SOME NOTES UPON THE COST OF SCHOOLS.

The regulations of the Board of Education in reference to school buildings state that no loan can be obtained from the Public Works Loan Commissioners for the purpose of erecting a school unless the total cost of the building scheme, exclusive of site, legal expenses, &c., is kept within the sum of £10 per head of the number to be accommodated. An allowance, however, will be made at the rate of £1 per superficial foot for a central hall if not reckoned in the accommodation, and also a further amount of 15s. to 20s. for rooms for special instruction as far as such rooms are authorised by the Code.* It is, however, not easy to keep the cost of a building as low as this. Mr Bailey,† when discussing the cost of the buildings of the London School Board, to which he is architect, points out that every effort is made to keep the cost as low as possible, and that the difference between a building devoid of all architectural features and built of nothing but stock brick with slate roofs, and one in which care had been taken to treat the arrangement with some attention to style and material, was less than 5 per cent.‡ The example quoted by Mr Bailey was that of the Princess May School, in which case the accepted tender showed a cost of £13. 18s. 4d. per head. This sum is within the amount allowed by the Board of Education when the various allowances have been added. It does not, however, include the cost of paving the playground, enclosing the site with a wall, &c. Some of the provincial School Boards, however, manage to get their buildings done for very much less. For instance, a school, illustrated and described page 331, built by the Manchester School Board, which has two halls of an unusually large size, with the

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* A further allowance is made for the use of glazed brick for the internal walls, as it saves money in maintenance.

† Paper on the Planning and Construction of Board Schools, May 1899.

‡ "The percentage of excess of cost between a school designed with regard to architectural effect and one of purely utilitarian construction is not great. Under ordinary conditions, satisfactory architectural results may be obtained at an increase of not more than 5 per cent. above that of the most 'practical' construction" ("School Architecture," E. M. Wheelwright, New York, 1901).

Infants' Department in a separate building, was completed ready for occupation, including all drainage to site, making playground, caretaker's house, and all fittings, for a sum barely over £9 a head. A large Board School recently built at Norwich with a large hall, and consisting of one storey only, for some 1,800 children, was finished at a cost of £10. 4s. 2d. per head, exclusive of the cost of the site.

The following table shows some recently erected Public Elementary Schools and their cost. The figures given are in all cases exclusive of sites, but include all other expenses :—

	No.	Accepted Estimate.	Per Head.
London School Board—			
*Church Manor, Greenwich - -	1,548	£22,281	£14 8 0
*Wickham Lane, Greenwich - -	1,548	20,440	13 4 0
*Stanstead Road - - - - -	1,548	21,787	14 1 5
†Burslem School Board, Staffordshire -	660	8,200	12 10 0
†Hornsey School Board—The Campsbourne Schools - - - - - -	1,410	20,467	14 10 3
‡Gloucester Board Schools - - -	992	11,548	11 13 0
§Board School, Chesterfield - - -	1,236	15,000	12 2 8
Birmingham—Conway Road School -	1,040	18,000	17 6 2
‖Wales Board Schools—Glyn, Neath—Central hall, five class-rooms - -	320	3,479	10 17 6
Church Schools, Wolverhampton - -	850	6,000	7 1 2

* *The Architect and Contract Reporter*, 3rd January 1902.

† In two blocks—(1) Hall 51 by 36 ft., and six class-rooms; (2) hall 45 by 28 ft., and four class-rooms. *The Builder*, 19th January 1900.

‡ *The Builder*, 28th September 1901.

§ There is included a pupil teachers' centre for 36, a swimming bath 75 ft. long, a laundry and cookery centre, two halls 90 by 30 ft., and sixteen class-rooms. *The Builder*, 15th January 1901.

‖ *The Builder*, 20th July 1901.

In a report recently presented to the Sanitary Institute by Miss A. Ravenhill there are some interesting figures given as to the cost of schools in America, from which it appears that a large City School of five storeys in New York can be built for 9½d. per cubic foot. This is not a great difference from those of the London School, which come out from 8½d. to 9½d. a cubic foot. In Germany the cost of the large schools in Berlin, with twenty to thirty-six class-rooms, lies between 11 and 12 marks a cubic metre.* In the case of Elementary Schools there is of course far more similarity than in the case of other schools, since all over the

* Handbuch der Architektur, vol. vi., part iv., p. 23.

country it is usual to allow the same amount of floor space and much the same number of rooms, so that some comparison can be made. In the case of Higher Schools the differences are naturally very great. A Secondary Day School can, by the exercise of the strictest economy, and by limiting the accommodation to the barest essentials, be built for between £25 and £30 a head, while a quite satisfactory building can be secured by spending from £45 to £50. A pupil teachers' centre now in process of erection in the Marylebone division, very much on the lines of that illustrated on page 210, but with the addition of a playroom in the basement, is being carried out by the London School Board at an estimated cost of £20,993.* This building consists of eight class-rooms, with an accommodation for 320, which means a cost of about £65 a head. This building would make an excellent plan for a Secondary Day School, and it is interesting to compare it with the plan of the Newcastle High School illustrated on page 196, which has about the same accommodation and cost under £9,000. This last was built by a private company, and provides ample accommodation for the number in a handsome building. The High Schools in America, which are large and very elaborate buildings, very fully equipped, and often allowing over 20 sq. ft. per head, cost from £90 to £130 per head.†

The cost of Boarding Schools may rise to a very large figure; anything from £200 to £600 a head may be required if many additional buildings are to be supplied, such as swimming baths, gymnasium, &c., and large playing fields, &c.

The buildings for Poor Law Schools vary from £100 to £200 a head. The Cottage Homes, illustrated and described page 379, were certified by the Local Government Board for 337 children, and an outlay of £51,000 authorised, or a little over £150 a head. The London School Board have recently worked out a scheme for dealing with deaf children by building a special residential building. The one proposed is at Anerley, and will accommodate 60 children in two blocks of semi-detached cottages. The accepted estimate for this is £19,000.‡ This seems rather a large outlay, coming to over £300 a head, though of course the price must be greater when dealing with small numbers and those of a special class.

There is of course considerable economy both in the initial cost and in the working of a school in which the numbers are large. For

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* *The Architect*, 3rd January 1902.

† The Teaching of Hygiene, U.S.A., Miss Ravenhill.

‡ *The Architect*, 3rd January 1902.

this reason mixed schools are usually more efficient in small centres of population. The question of the best way in which the expense of building can be kept down has already been considered when discussing the accommodation required.*

ON THE CARE OF SCHOOL BUILDINGS.

The actual care of the building and its supervision lie of course more immediately in the hands of the school-keeper, so that a few remarks upon his duties may not be out of place. The smooth working of the apparatus of the school and the comfort or the reverse of the inmates are to a large extent at the mercy of the school-keeper, who by ignorance or carelessness can completely upset the most carefully devised ventilating or warming apparatus. In the case of very large schools it is usual and indeed necessary to have a properly trained man in charge of the apparatus. In smaller schools this is not possible, but given a man of ordinary intelligence, the mysteries of the heating apparatus can be soon mastered. It is worth noting that unless a competent man be employed, it will probably be found that the extra expense caused by waste of fuel, injury to apparatus, and continual small repairs would make it cheaper in the long run to give a higher salary to obtain a better man. The school-keeper should be able to remedy small accidents himself, such as broken window panes, &c., and have sufficient knowledge of gas and electric light fittings to be able to keep them in good order.

All the class-rooms, cloak-rooms, halls, &c., should be thoroughly swept daily, the woodwork and furniture being carefully dusted after such sweeping. All dusting and sweeping should be finished thirty minutes before the time fixed for the opening of the school. The floors of all corridors, class-rooms, halls, and other rooms should be thoroughly scrubbed when necessary. This is generally, in the case of Elementary Schools, considered to be about once in three weeks, *i.e.*, one department every week. In Secondary Schools it is not necessary that it should be done so often, and in Girls' Schools, where, as only indoor shoes are worn, the amount of dirt carried into the building is small, it is required seldom. As little water as possible should be used, sluicing the floors with water not only may cause damage to the ceilings below, but destroys the floor, and the dragging about of heavy desks upon it while wet tears the boards

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* See page 65.

to pieces. Wood block floors should be washed as seldom as possible. Wet sand sprinkled about and brushed off with a stiff broom is best for ordinary use. In Saxony the regulations require that the buildings should be scrubbed out at least four times a year, with a daily sweeping and dusting. Painted work, such as dadoes, &c., should be washed with soap and water during holidays. Polished floors require considerable attention for the first year, but after that need wonderfully little care to keep in good order. To maintain them in good condition the following treatment should be carried out about four times a year; for the first twelve months it should be done about once every four weeks. The floors should be swept and then rubbed over with methylated spirit and raw linseed oil (mixed in equal quantities) with a clean flannel; after this the polish is to be rubbed over the floor, which should be then brushed and finished with felt. The polish * should be thoroughly well rubbed into the wood until a smooth but not sticky surface is obtained.

Window Cleaning.—Windows should be cleaned on the outside at least three times annually; in towns where there is much smoke and fog, four or even five times will be necessary. On the inside the windows that are easily accessible may be cleaned whenever they seem to require it. When the sashes are taken out, care should be taken to see that the fastenings have been made quite secure when they are put back, as accidents sometimes occur from their slipping.

Drains, Traps, Gutters, &c.—All eaves and other gutters or lead flats should be cleaned before the commencement of each term, and care taken to see that the wire gratings over outlets or heads of pipes are in order, especially in the autumn, if there are trees near the building. The gullies should be thoroughly cleaned, all solid matter, sand, &c., that may have collected, being cleared out. In dry weather care should be taken to see that these traps are kept well charged

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* A good wax polish is as follows :—

Yellow wax - - - - -	20 parts.
Yellow ozocerite - - - -	20 parts.
Linseed oil (boiled) - - - -	1 part.
Turpentine - - - - -	25 parts.
Raw sienna - - - - -	5 parts.

Mix the two waxes over a slow fire, add the colouring previously mixed with the oil, when cold add the turpentine.

with water to prevent any escape of gas. The disconnecting chamber should be occasionally examined and cleaned out.

The cisterns should be emptied and thoroughly cleaned during the vacations. The lavatories and all sanitary arrangements should of course be kept scrupulously clean. Where the basins are enclosed, the underneath parts should be cleared out once a week.

Care should be taken to see that trees and shrubs are not planted near buildings or walls, or tennis courts and paths paved with hard material. Creepers should as far as possible be kept to the plain surfaces of brick, and not trained round rain-water or other pipes, or over gratings, or upon roofs or gutters.

Heating.—Where open fires are used, they should be lit, if the weather is cold, at least two hours before the room is wanted for use. The openings of ventilating grates should be kept shut until the fire has been burning some time. Gas should under no circumstances be allowed for warming. In schools warmed by heating apparatus the school-keeper should of course attend strictly to the instructions given with the furnace. In frosty weather the fires should be kept alight night and day. It is a good plan to keep a small fire up during the winter vacation. The inlet valves for cold air should be shut at night during cold weather. Anything wrong should be attended to at once, as a large subsequent expenditure is often saved by prompt attention.

PART II.

BUILDINGS FOR ELEMENTARY EDUCATION.

PART II.—ELEMENTARY EDUCATION.

Chapter XVII.

General Description—Board Schools and Voluntary Schools—The Authorities dealing with Elementary Education—Different kinds of Schools under the Board of Education—Their Management, and Conditions under which Grants can be earned—Industrial Schools—Truant Schools—Reformatory and Prison Schools—Day Industrial Schools—Naval and Regimental Schools—Public Elementary Schools after 1870—Short Description of the different Acts—Management and Maintenance of Elementary Schools—Curriculum—Teachers—Different kinds recognised by the Board—School Staff and number of Teachers required—Laws of Attendance and means of enforcing Regularity—"Notice B" Committees and their Duties—Sources of Income—The "Code."

It is a much easier task to give a short and fairly comprehensive statement of the conditions of the elementary than of the higher education in this country. In marked contrast to the chaotic state of affairs prevailing in the field of secondary education, the Elementary Schools are well organised, well distributed, and by a complete system of Government inspection kept up to a high standard of efficiency.

The field of elementary education does, however, present one curious anomaly. There are two classes of schools, both doing the same work on almost identical lines, teaching a similar class of children, both undergoing the same inspection and receiving grants from the Government, yet one of which has a continual struggle to make both ends meet,* the other, depending on the rates, has practically all the money it requires—the Denominational or Voluntary Schools and the Board Schools. This is of course chiefly due to the religious difficulty, which is always cropping up in questions of elementary education. The Denominational

* Under the new Education Bill (1902) it is proposed to remedy this by making the Voluntary Schools also dependent upon the rates for their expenses in regard to staff salaries, &c., provided that they keep the buildings in a proper state of repair and efficiency (see Appendix B).

or Voluntary Schools, which did such excellent work, and in whose hands lay nearly all the elementary education in the early days of the Education Department, have not been able to keep up with the requirements of the time. The standard of education has risen so much in regard to buildings, equipment, teaching staff, &c., that schools which depend for support on voluntary subscriptions in districts perhaps already heavily rated are unable to meet the additional expense involved, and so it happens in many cases that their work has to be carried on in buildings badly lit and ill ventilated, often with an inadequate teaching staff. It is not always due to religious feeling alone that Voluntary Schools are preserved. "It is a real misfortune that the policy of keeping out School Boards arises not only within the Church from a sincere and honourable desire to secure definite religious instruction, but outside it also from a penurious anxiety to reduce rates to the lowest possible minimum" *—that is to say, it is often much cheaper to the district to keep a Voluntary School, which may or may not be doing its work properly, than it is to have a School Board and an efficient system of schools.

As Sir J. Gorst † points out, it is in the towns and large urban districts that the superiority of the Board to the Voluntary School is so much more marked than is the case in country districts, where the country clergyman is probably a far better school manager than the local tradesmen and farmers. It is worth noting that Scotland, where religious differences are perhaps more strongly felt and more eagerly debated than in almost any country, has never had any religious difficulty in school questions.

The authorities who deal with elementary education are :—

The Board of Education.—This has the control of some 30,000 schools, which consist of the Public Elementary and Higher Grade Schools; buildings for special instruction, such as cookery, laundry work, domestic economy, and manual training; schools for defective children, as feeble-minded and epileptic, deaf and dumb children; and schools for the training of teachers.

All these schools are conducted either by managers directly responsible to the Board of Education or to School Boards themselves responsible to the Board. These School Boards have to provide for the proper supply of schools and the due attendance at them of the children in their district, with the power of deputing any part of their

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* The Educational System of Great Britain and Ireland, Balfour. (Introduction.)

† *The Times*, 20th April 1898.

powers to local committees or bodies of managers. All Elementary Schools, in order to earn grants from the Government, have to be conducted in accordance with the "Code of Regulations" issued by the Board of Education, and to submit to such inspections by Government Inspectors as may be thought fit.

The Home Office.—Under the jurisdiction of the Home Secretary come Industrial Schools and Day Industrial Schools, Truant Schools, Prison Schools, and Reformatory Schools. By the Act of 1870, School Boards received powers of contributing to the establishment and maintenance of Industrial Schools, and since 1876, with the consent of the Home Secretary, of establishing such schools themselves. Day Industrial Schools were a further development of the Act of 1876. These are schools to which can be sent children of parents who habitually, and without reasonable excuse, neglect to provide for their proper education, or those children who will not go to school even when sent by their parents.

At these schools the children are compelled to attend daily, receiving elementary instruction and industrial training, and if necessary food. In case of non-attendance the absentee is at once sent for. There is at present only one of these schools in London, but owing to the success of this more are about to be established. There were in 1898, 24 Day Industrial Schools in the country, containing 2,161 boys and 740 girls. Of Industrial Schools there were at the same date in operation 142, with 12,943 boys and 4,415 girls.

Reformatories are schools to which are sent children up to the age of sixteen who have been convicted of an offence punishable with penal servitude or imprisonment, and such children must not by the Act of 1899 serve a previous time in prison.

Industrial or Truant Schools are for children up to the age of fourteen who may not have actually committed an offence, but who, if left in their surroundings and circumstances, are likely to become criminal; that is to say, the Reformatory Schools are for actual, the Industrial for potential delinquents, the children in the former being on an average three years older than the latter. To these schools also may be sent children who are incorrigible truants, or those who are beyond the control of their parents. The Inspector who is appointed by the Home Secretary is the same for Industrial and Reformatory Schools.

Under the Local Government Board come the Poor Law Schools to which pauper children are sent by the Guardians. Of course large numbers of these children, either from the workhouse or when boarded

out, or of parents in receipt of outdoor relief, attend the Public Elementary Schools. A certain number of Poor Law Unions have established large Boarding Schools for pauper children known as "District" or "Poor Law Schools," situated as a rule in the country outside and at a distance from the area covered by the Union. In these schools the children are carefully trained for different trades, perhaps the most successful branches for boys being sailors and bandsmen, while girls are trained for domestic service.*

The Regimental Schools come under the control of the Commander-in-Chief, and in them are taught the children of the soldiers, and also any particularly backward men. Similarly there are the Naval Schools under the Lords of the Admiralty, and about seven home training ships with some 2,500 boys, the education on which comes up to about Standard VI. of the Board of Education requirements. There is, however, an advanced class for algebra, trigonometry, and navigation. There are also three sea-going training ships, on board of which boys recruited at a later age are trained.† The foregoing list includes practically all the different kinds of educational institutions that come under the head of elementary.

The Public Elementary Schools under the Board of Education.—In order to understand the rise of the present system of elementary education, it is not necessary to go further back than 1870, except that it is perhaps worth noting that it was after the presentation of the Duke of Newcastle's Report in 1861 that the "Revised Code" was introduced, which combined all the grants and payments to each school into a capitation grant given on the attendance and results of the individual examination of the scholar. This system of payment by results continued for many years as the principle on which the Government grants were given to schools.

The Act of 1870 was the beginning in England and Wales of any general scheme of statutory provision for elementary education. It called into existence School Boards, as the local authorities who were bound to establish and maintain efficient Elementary Schools in every case where voluntary effort was unequal to the task either of providing such schools or of keeping those in existence up to the required standard of efficiency. Under this Act the School Boards could apply to the rating authorities for funds. They had the power of making bye-laws to enforce the attendance of children at

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* Children under the Poor Law, p. 86, Chance.

† Educational Systems of Great Britain, p. 77, Balfour.

school. It further separated secular and religious training, making the teaching of religion in schools managed by School Boards and dependent on the rates undenominational.

In 1876 a measure was brought in which gave local authorities further power of securing attendance at school of all children between the ages of five and fourteen, at the same time limiting the conditions of the employment of children under fourteen.

In 1880 it became obligatory on all School Boards and School Attendance Committees to make effectual bye-laws to secure the compulsory attendance of children at school, the age under which complete attendance was necessary being ten years. This age was raised to eleven in 1893, in which year was passed the Act providing special schools for deaf and dumb children, and in 1896 it became also necessary to make suitable arrangements for the education of mentally defective children.

In 1897 an Act was passed for the assistance of the poorer Voluntary Schools, supplemented by another for the relief of necessitous Board Schools, *i.e.*, schools which happened to be situated in particularly poor districts. In this year the system of payment by results finally disappeared. The whole tendency of elementary education in recent years has been in the direction of relaxing the bonds of red tape, and in attempts to suit the education to the needs of the children, the "Code" of 1900 giving very large powers to managers and teachers to adapt their curriculum to the locality in which their school is situated.

The year 1899 saw the passing of the Act establishing the Board of Education, which as far as elementary education is concerned carries on the duties of the old Education Department.

The constitution and functions of this body have been stated at some length when dealing with secondary education, and need not be gone into again here.

The conditions under which elementary education is carried on at present (1902) under the Board of Education are as follows:—

A sum of money is annually granted by Parliament for public education in England and Wales, the object of which grant is to aid in maintaining—

(*a.*) Public Elementary Schools.

(*b.*) Training Colleges for Teachers.

An Elementary School for this purpose means a school or department of a school at which elementary education is the principal part of the education given, and one at which the ordinary payments by the

scholars for instruction do not exceed the sum of ninepence a week. The name Public Elementary School implies (1) that the children shall be perfectly free in regard to religious instruction, being at liberty to be away from school if there is any day specially set apart for religious observance by the body to which their parents belong; the religious instruction in the school being arranged at the beginning or end of the day's work, so that any children whose parents so desire it can be withdrawn from such instruction without prejudice to their other work. (2) That the school shall be open at all times to the inspection of any Government Inspector.

The schools are managed (1) by School Boards who have the management of all schools provided by them, but who can delegate the whole or part of their duties to properly qualified managers; (2) by managers directly responsible to the Board of Education. These managers have to appoint a correspondent to deal with the Board of Education, and to keep proper minutes of their proceedings.

The age at which attendance is reckoned for the purpose of the grant is above three years and below fourteen. Attendance is not, however, compulsory below the age of five.

The curriculum consists of—

(*a*.) Infant School, suitable instruction in elementary subjects—Simple lessons on common things; appropriate and varied occupations; Singing and Physical Exercises.

(*b*.) The school for older scholars, *i.e.*, above the Infant School.

(1.) English, including Reading, Recitation, Writing, Composition, and Grammar, in so far as it bears on the correct use of language; Arithmetic; Drawing for boys; Needlework for girls; Lessons, including Object Lessons on Geography, History, and common things; Singing, which should as a rule be by note; Physical Exercises.

The above subjects are to be taken as a rule in all schools, although it is not necessary that they should all be taught in every class. Some may be omitted in any school which can satisfy the Inspector and the Department that there is good reason for doing so.

(2.) One or more of the following subjects is to be taken when the circumstances of the school, in the opinion of the Inspector, make it desirable:—

Algebra, Euclid, Mensuration, Mechanics, Chemistry, Physics, Elementary Physics and Chemistry, Animal Physiology, Hygiene, Botany, Principles of Agriculture, Horticulture, Navigation, Latin, French, Welsh (for scholars in Wales), German, Bookkeeping, Shorthand (according to some system recognised by the Department), Domestic Economy or Domestic Science.

(3.) Girls—Cookery, Laundry Work, Dairy Work, Household Management. For Boys—Cottage Gardening, Manual Instruction.

This long and imposing list is arranged for the purpose of giving a large amount of freedom and responsibility to teachers and managers so to frame the curriculum of their school as best to meet the requirements of the neighbourhood and class of children attending the school. Reading, Writing, and Arithmetic have to be retained as obligatory subjects for the purpose of Section I. of the Technical Instruction Act of 1889. Under this new "Code" of 1900 great freedom of choice is left to individual schools to develop on the best lines, for besides this long list any subject may be included in the course of instruction, if sanctioned by the Department.

The subject of teachers in the Elementary Schools is rather a complicated one, owing to the various plans by which older pupils and teachers in training known as pupil teachers assist in the regular teaching work of the school while themselves still undergoing instruction. There have been a large number of forms of organisations tried in the Elementary Schools of this country, from the system of Bell and Lancaster, in which one duly qualified teacher was considered able to manage a school of 1,000, assisted only by monitors and elder pupils, but little removed either in age or attainments from the children they were supposed to be teaching, up to the complete class-room system where each form not only has a class-room to itself, but a duly certified teacher in charge, as in the German Schools. These different schemes of organisation are treated in more detail when considering the best form of building adapted to them.* But the general tendency now is very strongly in the direction of the last-mentioned system, it being usual to provide a separate class-room for every class, with a properly trained teacher in charge, assisted perhaps by a pupil teacher in the case of very large forms. It is common to find pupil teachers in the Infant School.

The teachers recognised at present by the Department are seven, viz. :—

(1.) Probationers are boys or girls over thirteen and under sixteen, who must be approved by the Inspector, and who intend to become subsequently pupil teachers, and take to teaching as a profession. They must not be employed more than half their time the school is open, and must be receiving suitable instruction.

(2.) Pupil Teachers—Boys or girls can at the age of fifteen, or by special leave from the Inspector at fourteen, become pupil teachers. They have to teach in the school during school hours, being under the superintendence of the head teacher and receiving themselves suitable instruction. They have in each year

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* See pages 304-311.

of their time as pupil teachers, which lasts three years, or if admitted at fourteen four years, to pass the prescribed examination, their final examination being that for the Queen's Scholarship, the successful passing of which enables them to become (*a*) Students in Training Colleges; (*b*) Assistant Teachers; (*c*) Provisionally Certificated Teachers.

(3.) Provisional Assistant Teachers are those who have completed an engagement as pupil teachers, but have failed at the end of it to pass the Queen's Scholarship Examination. They may, on the recommendation of the Inspector, be granted an extension of two years, during which time they are at liberty at any time to make a further attempt to pass the examination.

(4.) Assistant Teachers are those who have either successfully passed the Queen's Scholarship Examination, or who, being over eighteen years of age, have passed University or other examinations recognised by the Department.

(5.) Provisionally Certificated Teachers—Pupil teachers who, after the satisfactory completion of their course, have taken a first class in the Queen's Scholarship Examination, may, if specially recommended by the Inspector, be so recognised, as also may, by a special recommendation, persons who have served for not less than twelve months as assistant teachers.

(6.) Certificated Teachers—Candidates for certificates, except in special cases, such as those qualified by examination to become graduates at the Universities, &c., must be examined twice, and undergo probation by actual service in school.

The first examination is open to those who have been students for at least a year at a Training College, or being upwards of nineteen years old, have been employed for at least two years as provisionally certificated teachers, or one year as assistant teachers in properly inspected schools.

The second examination has to be passed by all candidates for a certificate, except those persons who have passed certain examinations recognised by the Department, and also hold a certificate of proficiency in the Theory and Practice of Teaching issued by some recognised body.

A Parchment Certificate can be obtained on a favourable report of the Inspector by a certificated teacher after eighteen months' service in the same school or Training College.

(7.) A woman over eighteen years of age, approved by the Inspector, and who is employed during the whole of the school time in the general instruction of scholars in the lower classes, and in teaching needlework, is recognised as an additional teacher.

The minimum school staff required is calculated on the following basis :—

	Average Attendance.
The Principal Certificated Teacher	50
Each Additional Certificated Teacher	60
Each Assistant Teacher	45
Each Provisional Assistant Teacher	30
Each Pupil Teacher	30
Each Additional Teacher	30
Each Probationer	20

The schools are divided into (1) the Infant School; (2) the school for older scholars, in which there is either a separate department for boys and girls, or both are taught together, in which case the school is called a "Mixed School." In London, Mixed Schools are less common; the usual plan being to have three floors, putting the Infant School on the ground floor, the girls on the first and the boys on the second floor.

The school above the Infant Department is divided into seven standards, each standard having a carefully defined limit of attainment on a scale fixed by the Education Department.

There is usually in the larger schools a standard above the seven regular divisions known as the ex-seventh, in which the work done may be much the same as a Higher Grade School—that is, carrying on and completing the elementary education of a boy who is willing to stay at school for a year or two beyond the time of actual compulsory attendance. Promotion from one standard to another is made by the head teacher, but no pupil is held to have passed any particular standard for the purpose of exemption from school except upon a special examination by the Inspector.

The law of attendance at present in force as to attendance at school is as follows:—Every child between the ages of five and fourteen must attend regularly* some certified efficient school, unless he is being properly instructed in some other way to the satisfaction of the authorities. In the case of deaf and dumb children, or those mentally defective, the age of compulsory attendance at school is increased to sixteen years with no form of exemption.

Children attending schools at which the fees for instruction are more than ninepence a week do not come within the range of the law as to attendance, as such schools are supposed to lie outside the sphere of School Attendance Acts.

The School Attendance Act of 1899 raised the minimum age of exemption to twelve years, at the same time raising the standard required to obtain exemption, so that now no child may leave school before the age of fourteen, unless being over twelve years old they have passed the seventh standard at a special examination by the Inspector. This makes it difficult for any one to get away from school much before the age of fourteen. At the same time, the old system of granting half-time or passing certain standards at the required age has been totally done away with.

Arrangements to ensure regularity of attendance at school are

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* *i.e.*, ten times a week, whenever the school is open.

made by the School Boards for their own districts; the final resort being to summon the parents in the Police Court, or before two Justices of the Peace at Petty Sessions, the maximum penalty being 20s., or imprisonment in case of default of payment.

The London School Board have established School Attendance Committees in all the districts under their jurisdiction. The School Board visitors, as the officials concerned with school attendance are called, serve notices on such parents who will not, after due warning, send their children regularly to school, requesting them to appear before these Committees, and give any reason or excuses they may have. After hearing their story the Committee try to find some plan of arranging matters—in case of illness giving a medical certificate to be filled up; sometimes, in case of sudden temporary distress, where it is absolutely necessary that there should be some one at home to help, they can, by not putting the law in force, or rather by taking no notice of the absence, allow a child so many mornings or afternoons away from school for a short time. If the reasons given seem untrue or inadequate, they can either warn their parents strongly, or direct that a summons be taken out.

These Committees, known commonly as "Notice B" Committees, from the heading of the notices requesting the attendance of the parents, stand between the parents and the law. They weed out the cases for the magistrates, and by being able to make arrangements to tide over cases of temporary difficulty by settling many cases of complaints and misunderstandings between parents and teachers relative to attendance, and by not having recourse to the law until every means of persuasion, advice, and threats are exhausted, save a very large number of cases from coming into the Police Courts.

The income necessary for carrying on the schools is provided by—

(1.) The Government Grants applicable to Board and Voluntary Schools:—(*a*) Education Grant for Day Schools; (*b*) Grants for Schools for the Blind, Deaf, and Defective Children; (*c*) Education Grant for Evening Schools; (*d*) Fee Grant (when taken); (*e*) Grant from the Science and Art Department; (*f*) Grants from the Home Office for Industrial Schools.

(2.) For Board Schools only, the School Board rate.*

(3.) Pupils' fees and voluntary subscriptions, which are of course practically confined to non-Board Schools.

Having thus briefly reviewed the conditions under which the

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* Now to be extended to Voluntary Schools (see Note on new Education Bill, p. 21).

elementary education of this country is carried on, we can now pass to the buildings. These, in order that the schools may earn a grant from the Government, have to be erected, or, as far as may be practicable, be made to conform to the regulations issued by the Education Department, *i.e.*, Schedule VII. of the "New Code." * Under these regulations there is considerable latitude left to the Boards as to the actual arrangements, &c., of their buildings.

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* See Appendix A, where the regulations are given in full.

Chapter XVIII.

DEVELOPMENT OF THE MODERN TYPE OF ELEMENTARY SCHOOL.

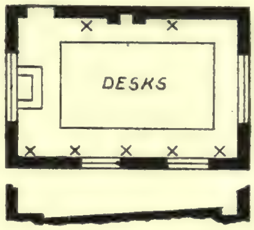
Short Description of the various Elementary School Systems, leading up to their present organisation—The Bell and Lancaster System—Stow's System—Wesleyan Schools—Pupil Teacher System—The "Prussian" or Class-room System—The "Ben Jonson" School—Criticisms on, at the time—Adoption of the Central Hall System—The Development of the Modern Type of Elementary School Building.

Before passing on to the consideration of the modern type of Elementary School, it may be of interest to state shortly the various steps which have led to the adoption of the present form of building and system of teaching. And as so many of the schools now in use owe their form and arrangement to some system of teaching that held sway for some time to be replaced by another, it will be necessary to consider briefly the more important of those methods which have left their mark in the buildings.

It was at the end of the eighteenth century that Joseph Lancaster started his schools on somewhat similar lines to those which had already been put on foot by Dr Bell, who, when in India, had been much impressed with the value of mutual instruction, that is to say, the instruction which pupils receive from their fellow-pupils; his idea being that one who has just learned a certain thing himself will know the difficulties better, and be more clearly able to explain them to another, and present them in a form more easily intelligible to the learner from having so recently conquered them himself. The school was worked in this manner:—The master or superintendent conducted the entire school through the agency of the scholars themselves; the school was divided into small classes of equal proficiency; the children were sometimes paired off, an inferior being taught by a superior boy; to each class was attached one, or if the class was large, two teachers, themselves boys but little removed in age from the class they taught. The master of the school taught his monitors

and class teachers out of school, doing little or no actual teaching during school hours, which indeed he could have had but little time for, as one master would have to manage a school of perhaps a thousand, his time being taken up with supervision, and in stimulating the work going on. The arrangement of the school building was simple. It consisted of one large oblong-shaped school-room (see Fig. 252), with windows 6 ft. from the floor, the floor being slightly inclined upwards from the master's desk to the farthest end of the room, where the highest class was placed. The master's desk was on a platform 2 or 3 ft. high. Fixed forms and desks occupied the middle of the room, a passage of 5 or 6 ft. being left between the ends of the forms and the walls, in which space the children formed semicircles for reading.

The advantages and disadvantages of the system are thus summed up by Mr J. H. Cowham.* It was cheap, and brought some form of education within the reach of all; the numerous classes allowed a rapid promotion of clever children; all were working under direction instead of being left to themselves as in the old system, and provided there was a good supply of superior children it worked well as far as regards the young children. At the same time the teaching was mechanical and uninspiring. In order to provide some incentive to work, it was necessary to have a very elaborate system of rewards and punishments. While all in the school received some education, few became really efficient. Finally there was a natural objection on the part of the parents either to their children spending all their time teaching, or to their being taught by their schoolfellows. Bell and Lancaster themselves, however, regarded their schemes with extraordinary enthusiasm, looking upon themselves almost as prophets, and foreseeing the day when this system should be in use throughout the world.† It soon, however, became apparent that although the monitorial system had some advantages, the greatest perhaps being that of cheapness, the results of the system could not be considered satisfactory. It was pointed out by Stow, who instituted the form of school known as the Glasgow or Training School in 1826, that while monitors may be able to teach facts which they have learned according to the rote system, such as the sounds and names of the letters or words, they cannot work the



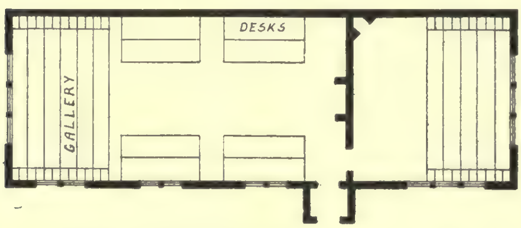
252. A LANCASTERIAN SCHOOL.

* School Organisation. 1896.

† Educational Aims and Methods, Sir J. Fitch.

facts into the minds of their classes, they do not possess the requisite authority, nor can they give any moral training. The main idea of Stow's system was :—The employment of skilled teachers whose influence over the children should be direct and continuous; they were to be with the children in the playground, or, as he called it, the uncovered schoolroom, and incidents observed there were used as illustrations or examples for the purpose of moral training.

In teaching, the main object was to induce the children to think and acquire knowledge for themselves instead of being told. Great pains were taken by fitting up the playground with apparatus and by systematic drill to ensure the physical development of the children. It was his condemnation of the system of monitors and demand for skilled and trained teachers which led the way to the pupil teacher system, which was then devised in order to provide proper training of skilled teachers, and a means whereby they could be obtained. A school planned on Stow's system was arranged as follows (see Fig. 253):—At one end of the large schoolroom was a gallery. Owing to the necessity of complete supervision, Stow regarded this as indispensable. This gallery was large enough to accommodate at least two-thirds of the school. There was an open floor space having about twice the area of the gallery. There were two long desks at each side of the door to accommodate the children who could be drafted off there for writing, and at the opposite end of the school-room to the gallery were one or two class-rooms, each of which also had a gallery.

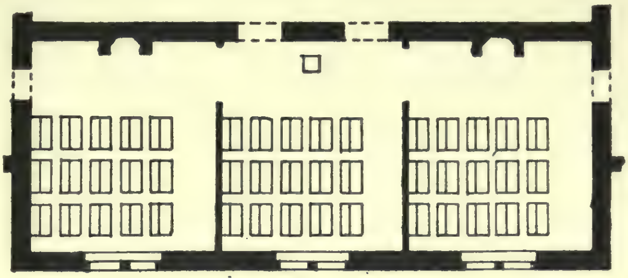


253. A SCHOOL ON STOW'S SYSTEM.

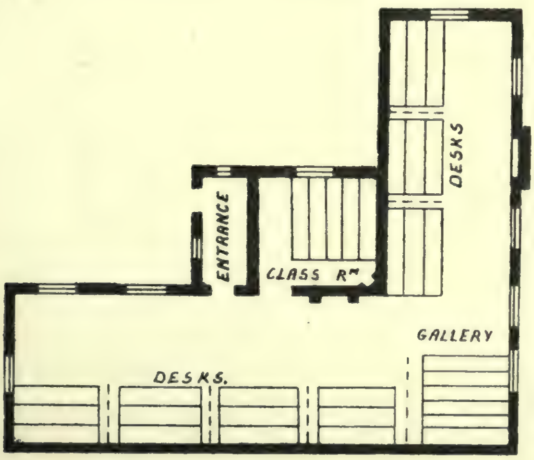
These arrangements were usually adhered to, although of course various modifications were made. The schools were graded with Senior, Junior, and Infant Departments, boys and girls being taught together. The Wesleyan Schools were usually arranged on this plan, with gallery of proportionately much greater size, but these schools were built quite as much with a view to their use as Sunday Schools as for ordinary work. For the satisfactory working of this plan a large number of pupils were required in order to allow of proper grading.

The pupil teacher system as now in vogue is a development of the preceding system. It accepts from the monitorial system the plan

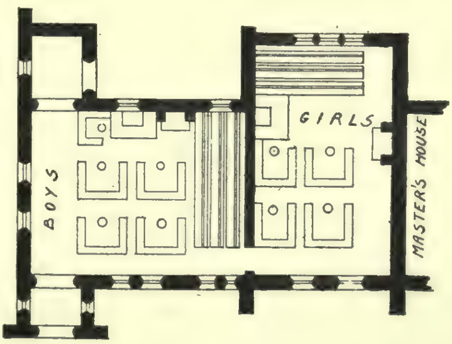
of taking the pupil teacher from the ranks of his fellow-pupils, but there the resemblance ends. The pupil teacher is not allowed to teach until the age of fifteen, and then only after a certain examination has been passed. The pupil teacher is paid for his or her services, and is probably preparing for a teaching career, learning the art of teaching as a means of livelihood, instead of, as in the old Lancasterian system, merely undertaking it as a temporary and unpaid employment. In schools arranged on the pupil teacher system it is usual to find long narrow class-rooms in which blocks of desks can be either screened by curtain or other forms of partition, or left open (see Figs. 254, 255), so that the master can effectually supervise all the work going on. It was a very common plan to have



254. A School-room on the Pupil Teacher System.



255. School Arranged on the Pupil Teacher System. Classes divided by curtains.

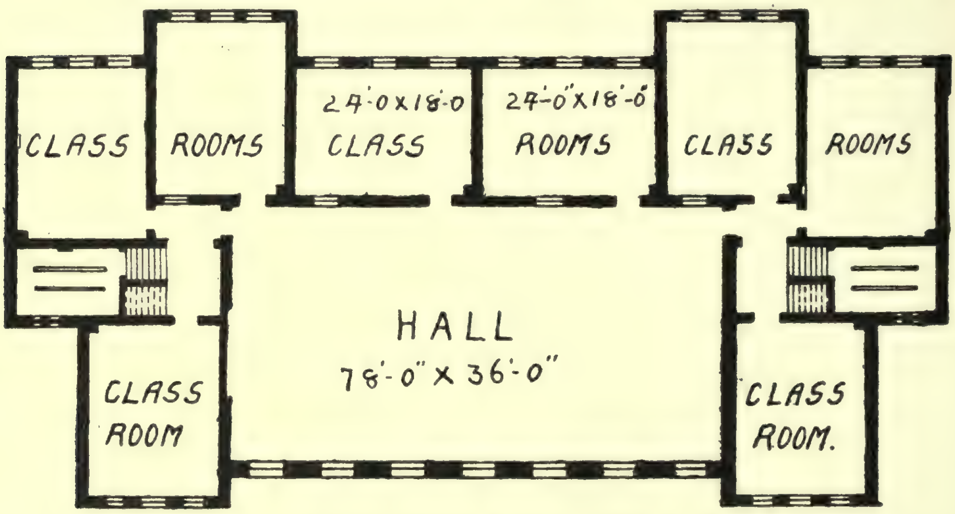


256. A Village School about 1840.

an L-shaped room, with perhaps a class-room containing a gallery at one end. The school then would be arranged somewhat on the lines of Fig. 255. Fig. 256* shows a plan of a Country School in the

* From Designs for Schools. H. E. Kendall. 1847.

early part of last century, arranged for one master assisted by pupil teachers who would take their forms in small groups. But even as late as 1870, school building had not got beyond the point of a large school-room, divided sometimes with curtains, and with one or perhaps two class-rooms. In 1871 * the London School Board determined to obtain information about the Prussian plan of school building, and to see whether such a system would be applicable to London. Finally, after much argument, and apparently with considerable misgivings, the Board determined to build a school on the following conditions:—That the two departments above the Infant School, viz., the older boys and girls, should be divided into classes of not more than 80 each, and that a separate teacher for each class should be provided, the



257. THE BEN JONSON SCHOOL. Built in 1872.

T. Roger Smith, Architect.

general school-room (centre hall) being available for one class. The accommodation to be provided for the school was very greatly in advance of any previous building. One of the class-rooms was to have a top light, so that it should be available for drawing. Further, each department was to have proper accommodation for the teaching staff.

There was a competition in which twelve architects took part. The design sent in by Mr T. Roger Smith was judged to be the best, and the result was the school now known as the "Ben Jonson" School in Stepney. This is a most interesting school, especially in view of its date.

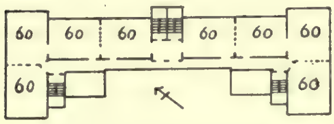
* T. H. Spalding, The Work of the London School Board, pp. 63 to 68.

On looking at the plan of this school (Fig. 257) it will be at once seen what a very great advance it was on any previous building, the general scheme of the plan being very closely on the lines of the type of school now usually built by the London School Board, *i.e.*, with all the class-rooms opening off a central hall. The rooms are in nearly all cases lit from the left side, two being lit from the back only. The lighting would, however, hardly be considered sufficient when judged by modern standards, but the whole arrangement of the building is admirable. The system of arranging for the accommodation of the teachers on mezzanine floors—a plan now usually adopted—is here found for the first time. Curiously enough this school found so little favour at the time it was erected, that it was considered to be a failure, and no similar buildings were erected for a considerable time. Mr Robson in his book on School Architecture in 1874 came to the conclusion that the plan of this building was unsuitable for an Elementary School chiefly on the grounds of its great size, saying that the gathering of a large aggregation of children into one building was condemned by the experience of all Europe; secondly, on the comparative uselessness of the hall; * and thirdly, on the great expense involved in such a system of class division. These objections have not been supported by subsequent experience, nor is it, at all events at the present day, the fact that the feeling of Europe is against large schools. In Germany, for example, it is quite common to find schools of 2,000 or more. It is curious to note that this school, though condemned as a failure in 1873, is practically the prototype of the modern Board School, and that although one of the strongest objections to it at the time was its great size, it has been twice added to since.

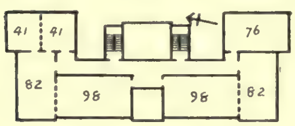
The School Board having decided that their experiment was not a success, gave up the idea for the time of having separate rooms for each class as a general rule, and proceeded further to elaborate the pupil teacher system. This required a building with long narrow rooms in which a number of classes could be placed; a type of plan which is peculiar to this country (see above, Figs. 254, 255). After this time the influence of the German system of school planning can be very strongly traced, and as the hall or large school-room not used for regular teaching had been settled to be a great waste of space, a very large number of schools were erected on the principle of the

* It is only right to note that Mr Robson, when writing on the subject some years later, expresses the opinion that the central hall is indispensable, and gives the best form of plan for a school. "The Planning of Schools," *The Builder*, February 1888.

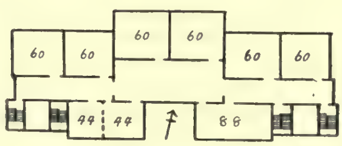
corridor with rooms opening off it (see Fig. 258). The schools about this date show a curious medley of plans, being apparently to a large extent attempts to combine the English and German types. See Fig. 259, which shows the reversion from the "Ben Jonson" type of school to that of the large class-room taking 80 to 100 children. However, the tendency in all the various forms which the schools took at this time was in the direction of increasing the number of class-rooms and in widening the corridor, which was evidently found very useful in the discipline of the school for forming up the children at dismissal, &c. Fig. 260 shows a school in which the corridor has become of considerable width, and nothing but a small increase in size is required, as in Fig. 261, built a few years later, for the corridor to become a hall. This school, built in 1882, is practically a reversion to



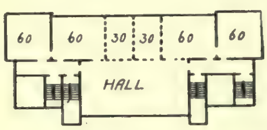
258. Cranbrook Road.



259. York Road.
1874.

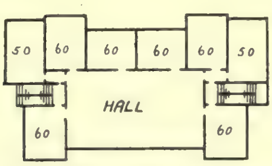


260. Gloucester Road.
1875.

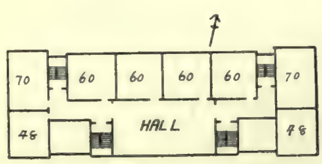


261. Mina Road.
1882.

the "Ben Jonson" type of plan, and with a few minor alterations, has continued as the form in which the London Board Schools are built to the present time (see Figs. 262, 263). It was not, however, adopted for all schools immediately, and many schools were still built of various forms, but after this year, 1882, the hall or large school-room always



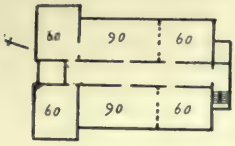
262. The Ben Jonson School.
1872.



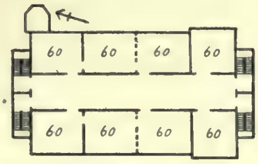
263. Culloden Street School.
A Modern Board School. 1900.

appears, whatever type of plan is used, provided of course that the site will allow room for it. The series Figs. 264-266 show another form of plan, a corridor with class-rooms opening off it, also commonly found in German Schools. This again naturally widens into a hall. The form in Fig. 266 is that which was adopted ten years later for the Hugh

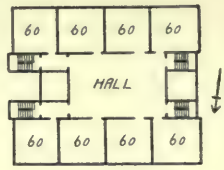
Myddleton School (Fig. 267). It is interesting to compare Fig. 265 with a recently erected school in Manchester, which is merely the same idea on a larger scale. Fig. 268 shows another way in which a hall with class-rooms opening off it on all four sides would arise, for in the



264. COMPTON STREET.
1881.

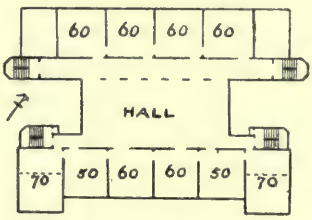


265. BATH STREET.
1881.

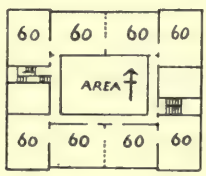


266. ST JOHN'S ROAD.
1883.

case of a school (as Fig. 268) built round an area, it merely requires covering in to form a central hall, as in Fig. 266. The form of school arrived at in 1882, and practically adopted for the London Schools during the next few years, has remained in vogue since that time with practically no alteration except in the direction of better lighting, small



267. THE HUGH MYDDLETON.
1893.



268. HAGGERSTON ROAD.
1879.

improvements in detail, and more careful graduation in the size of classes; and for schools organised as the London Elementary Schools are, it is not easy to see in which direction improvements are to be looked for, as far as the general scheme of the building is concerned.

The above diagram plans are taken from the report of the School Management Committee of the London School Board.

Chapter XIX.

LARGE ELEMENTARY SCHOOLS.

Area required for Playgrounds—Area of Sites in German Schools—Position of Building on Site—Block Plans of Manchester, Edinburgh, Hornsey, and London Board Schools — Block Plans of German Schools — Covered Playsheds — Drinking Fountains — Paper Baskets — Caretaker's House — The Size of Classes — Need for graduations in the Size of Class-rooms—Maximum Size of a School—"Mixed" and "Separate" Schools — Proportion of Infants to older Scholars — Height of the Building—The number of Class-rooms required—The Hall—The Accommodation given in a Modern Elementary School—Cloak-rooms—Rooms for Special Instruction—Infant Schools—Examples of Schools, with Plans—The Cobbold Road School, Chelsea—Campsbourne Schools, Hornsey—Varna Street School, Manchester—Conway Road School, Birmingham—The Great Horton Board School, Bradford—The Bruntsfield and Broughton Road Schools, Edinburgh—Alexandra Parade School, Glasgow—Examples of German Schools: Berlin, Mannheim, &c.—American Elementary Schools, with Examples—Comparative Survey of American, German, and English Elementary Schools.

THE questions of site and aspect considered in Chapter V., in regard to Secondary Schools, are of course equally applicable to Elementary Schools, and need not be repeated here.

Area necessary for Sites and Playground. — The area provided for the playground is naturally governed to a large extent by the position of the school and the financial resources available. The minimum amount of superficial area is laid down by the regulations of the Board of Education as 30 sq. ft. per head. It is by no means always easy in the case of a school built in or near the busy part of a town to secure as much as this, but no effort should be spared to provide as large playground as possible. As Mr Bailey, the architect to the London School Board, speaking of restricted sites, says:— "As, whatever the difficulty, sufficient space to ensure light and air *must* be obtained, the playground question is usually best solved by providing on the ground level for the boys and infants, and putting a flat over the whole top of the building to form a playground for the

girls, which should not be enclosed entirely by a wall, but should have either panels filled with iron grills or some lengths of railing, as otherwise the natural curiosity of the child to see what is beyond might lead to unpleasant, not to say dangerous consequences. Such playgrounds do not give more than 10 or 12 sq. ft. to each child, however." *

The whole area of the site for an Elementary School, including buildings and playgrounds, should probably not fall much short of 2 acres in the case of a school of any size, say 1,500 or over, or of a school which is so placed that other buildings may in the future be brought close up to the boundary, in which case the resulting increase of population will require additional school accommodation, while the land required for adding to the school and playground will become unobtainable. Mr Bailey gives 2 acres as the size that he considers advisable for a new school. In a large Board School recently erected at Manchester (see Fig. 269), the site, including buildings, contains 8,525 sq. yds., or rather under 2 acres.

In Germany the sites are, as a rule, smaller than those in this country. Much space is also taken up by various buildings—a gymnasium, caretaker's and Headmaster's houses, a garden with carefully laid out beds and grass plots—so that the space left for actual playground is in the end very much smaller than the amount which would be considered sufficient in this country. For instance, in a number of the large Elementary Schools in Berlin, taking those of much the same size, viz., schools containing about thirty-six class-rooms, which would mean not less than 2,000 children, the sites, including all buildings, vary from 4,500 to 6,500 sq. metres, *i.e.*, from just under an acre to about 1⅙ acre. The area of the buildings varies from 1,500 to 2,000 q.m. A further 500 q.m. must be deducted for the usual gardens in front, leaving the space available for playground between 2,500 and 4,000 q.m. This means about 1½ to 2 q.m. per head, or say 15 to 20 sq. ft. In some places considerably less is found. In Leipsic, for instance, in the case of a school for 2,070 children, while the area of the whole site comes to 6,200 q.m., or about 1¼ acre, of this, when the space occupied by buildings, gardens, &c., has been deducted, there is only left 2,214 q.m., or scarcely more than 1 q.m. (10 sq. ft.) per head for playground. These gardens have, however, the advantage of keeping the buildings back from the street,

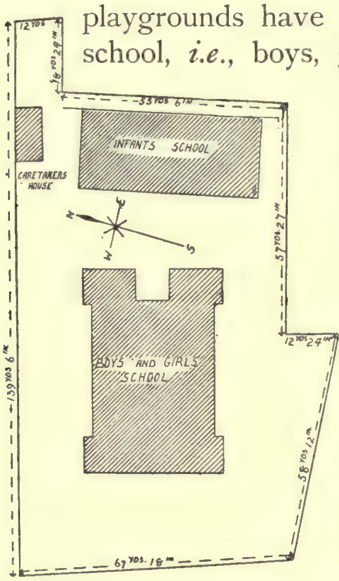
* The Planning and Construction of Board Schools. Paper read to the R.I.B.A., May 1899.

and so stopping the noise, besides adding considerably to the appearance of the school. In the case of small country schools the amount of playground is naturally of less importance, but there should be ample room for all the children during a recess. The minimum allowance of 30 sq. ft. can generally be managed without difficulty.

In setting out the buildings on the site, care has to be taken, in the case of town schools, that the school building should be well back from the street.

The buildings should be carefully placed so that they do not interfere with the playground more than can be helped. Separate playgrounds have to be provided for each department of the school, *i.e.*, boys, girls, and infants. These are divided from one another either by a wall or an iron railing, as may be preferred. Sometimes they are separated only by marks on the ground. The girls' and infants' playground are often combined, the same ground serving for both departments.

Fig. 269 shows the block plan of a school recently erected in Manchester. The school lies well in the middle of the ground, and would even, if built up to all round, still have enough room to obtain sufficient light and air; the Infant School, which lies near the boundary on one side, being lit, as far as the class-rooms are concerned, from the playground side. The offices, not shown, are arranged in the playground well away from the building.

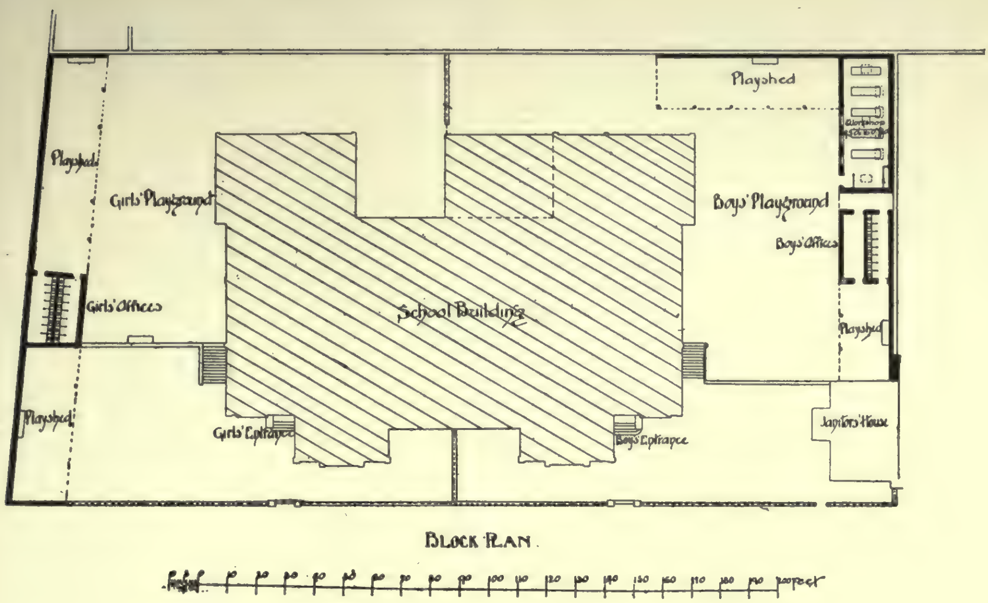


269. Varna Street School, Manchester.
Potts, Son, & Hennings, Architects.

Fig. 270 shows the site plan and arrangement of the school buildings in a school in Edinburgh.

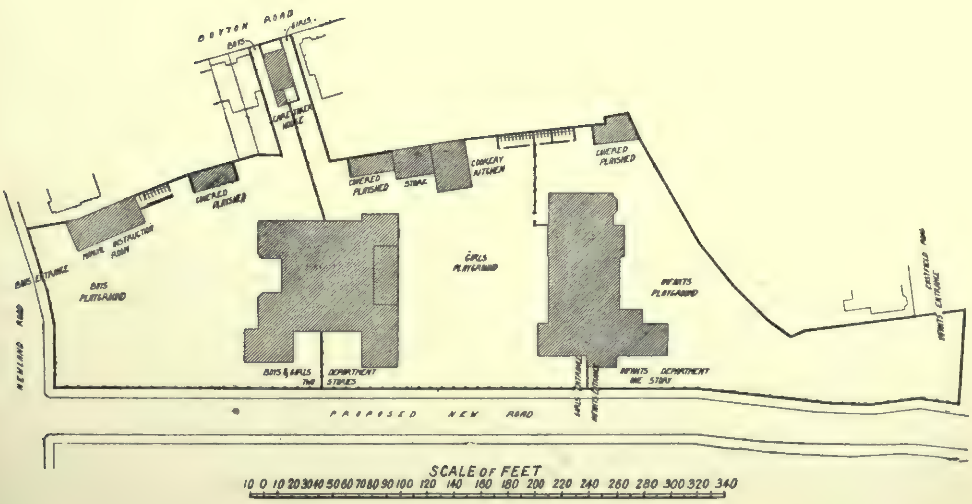
In Fig. 271 is shown the site plan of a large Elementary School recently erected at Hornsey. This plan shows well the division of the playground. There are entrances for the boys and girls each into their own playground from different streets, while that for the infants is close to the girls. In the ground for each department is a covered playshed and offices, there being a manual instruction building in the boys', and one for cookery instruction in the girls' playground. The caretaker's house is placed at one of the entrances, and well out of the way.

Fig. 272 shows the site plan of a London Board School.



270. THE BRUNTSFIELD SCHOOL, EDINBURGH.

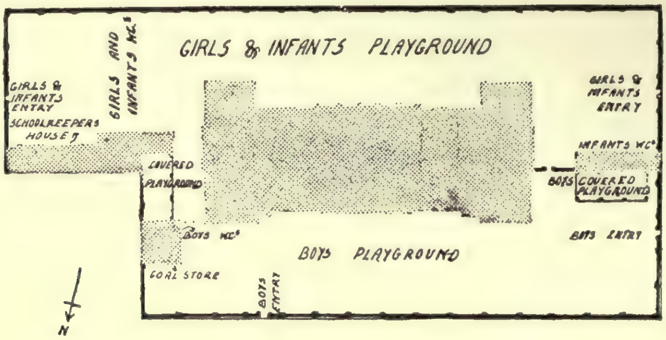
Robert Wilson, Architect.



271. THE CAMPSBOURNE SCHOOL, HORNSEY.

H. Chatfield Clarke, Architect.

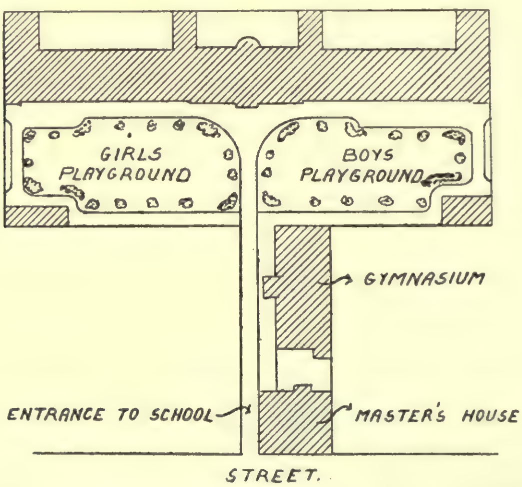
Attempts are being made to take somewhat from the rather dreary and forbidding aspect of a large Elementary School and its playground, by planting in places where it can be done without too



272. The Cobbold Road School, Chelsea.

T. J. Bailey, Architect.

much chance of injury. Of course it can only be thought of where there is a considerable amount of room, and where it is not imperative to use every inch of available ground for playing room. In Germany



273. Elementary School, Christburgerstrasse, Berlin.

274. German Elementary School.

an allowance for planting, &c., always forms part of the estimate in a building scheme.

In Fig. 273 * is given a plan showing the arrangement of a large

* From Schulhygiene, A. Baginsky.

newly built Elementary School at Berlin having a fair-sized area of ground, but with a very small frontage to the street. This narrow piece is taken up by the Director's or Headmaster's house in the street and the gymnasium, leaving a way through to the school playground, on to which all the class-rooms face, thus securing freedom from noise and plenty of air. This scheme would probably meet with objection in this country, since the boys and girls must use the same entrance to the school grounds. The plans of this school with an exterior view are shown below (Figs. 307-311).

The plan of separating the two sexes is sometimes found in Germany. Fig. 274 shows a block plan of such an arrangement, the gymnasium being placed in the centre, and common to both.

Covered Playsheds.—A covered playshed should always be provided if possible, which should be say 60 by 20 ft. at least, and placed in the sunniest corner of the playground. Unless this is provided, children have in wet weather nowhere to play during the intervals except in their class-rooms, which cannot then be properly aired, or in the hall, where the noise would create considerable disturbance. Such a shed has also other uses; in summer drilling classes can be taken there; children who bring their dinner to school can, if there is a seat provided at the back, eat it there, and so avoid using a class-room for this purpose. The easiest and cheapest plan to accomplish this is to put up a corrugated iron covering in a corner of the playground, making use of the boundary walls to form the back and one side.

A drinking fountain should be always supplied in the playground, the water to which is best laid on direct from the service main.

Where many children bring their dinner, it is as well to provide some boxes in convenient situations in the hope that the children may be thereby led to put the paper in which their dinners were wrapped. Mr Bailey also suggests building projecting slabs of stone (millstone grit) into the wall at intervals for the purpose of sharpening slate pencils on, but with a warning that their position should not offer facilities for climbing on to any adjacent roofs, &c. This is to save the brick wall from defacement. The practice of using slates is being strongly discouraged now in favour of pencils and paper, so that this precaution is perhaps less needed now.

A Caretaker's House has also to be provided, which should be situated close to the entrance, or one of the entrances. This should

consist of three bedrooms, a good-sized living room and scullery, and offices, with a small yard at the back.*

New Buildings.—When a new school building is projected, the first question that naturally arises is the number for which it is necessary to provide. This is of course settled by the locality in which the school is to be placed. The question of increase,† and the extent to which this is likely, has of course to be taken into account, the building being so arranged as to allow of additional accommodation being added as economically as possible. It may probably be assumed now that a school of any size will be organised on the principle of having a separate class-room for every class—that is to say, providing class-room accommodation for the entire school without reckoning the hall. In the case of small schools and village schools the case is somewhat different.‡

Size of the School.—Opinions differ considerably on the question as to what should be the maximum number of children in one school. The London School Board have come to the conclusion that no school should contain more than 1,548 children in one building—that is, three departments of 516. There are in some of the large provincial towns numbers of schools which contain a greater number than this. For instance, the school at Manchester shown in Figs. 286-291 has accommodation for 2,000 pupils. In this case, however, the Infant School of 500 is in a separate building. In Germany it is common to find schools of 2,000 or more. Except on the ground of increased risk of contagion in case of infectious illnesses, there seems little harm in these large schools, provided the building is well planned.

The Board of Education, however, have recently (March 1902) communicated to the London School Board their opinion that no school should exceed 1,000, arranged in three departments, 300 boys, 300 girls, and 400 infants, and that in future a school of 1,200 would only be sanctioned in exceptional circumstances. It is difficult to see any good reason for this limitation in size; the large schools with departments of from five to six hundred in nearly all cases show the best results, since with these numbers it is possible to have every class taught separately, even in the upper standards, while making it possible

* For details of this see Building Regulations, Appendix A.

† It occasionally happens that in a place like London, where the population is continually shifting, that there is a great decrease of pupils.

‡ See below for village and small schools, pages 364 *et seq.*

to graduate the pupils more effectually according to their proficiency. On the score of expense the advantage is so strongly in favour of the large school, that unless a great superiority could be proved to result educationally from this division of three larger into five smaller schools, it would seem to be putting an unfair tax upon the ratepayers, already heavily burdened by the cost of the schools. The increase in sites, building, and cost of maintenance caused by such limitation would probably be from 10 to 15 per cent.

The plan of the school will depend of course to a large extent on whether the school is to be a "mixed," *i.e.*, both sexes taught together, or a "separate" school, with separate departments for boys and girls. In either case the Infant School is a separate department, and always "mixed." In the case of very large schools, where there are sufficient numbers to secure proper grading, there is not so much importance in the question of "mixed" or "separate" as far as the organisation is concerned, but in the case of small schools and country schools, to combine the two departments of the upper school certainly adds very greatly to the efficiency in ease of organisation, economy of building, and in the staff required. The educational aspects of the question hardly concern us here. Head teachers of mixed schools generally speak highly of the plan, which is universal in America. In Germany the sexes are taught as a rule separately. While in London "separate" schools are more usually met with, in the country and large towns "mixed" schools are perhaps more common.

Proportion of Infants to Older Scholars.—The relative proportion between the Infant Department and the Senior School is variously laid down by different writers. Mr Robson * suggests that of 1,040 children there would be 400 in the Infant Department, and 320 in the Boys' and Girls' respectively. The present system of the London School Board is to make the three departments equal, for while the Infant School combines both girls and boys, and so apparently should be much larger, yet as the time spent in the Infant School is just about half that spent in the older school, the numbers should be equalised. But it should be remembered that if the school is situated in a poor quarter, a large number of parents will send their children to school at three, the earliest age allowed, in order to be relieved of them, while they themselves go out to work. In fact, in many schools there is a special room † called the babies' room, which is practically a crêche for

* School Architecture, p. 164.

† See below, Infant Schools, p. 324.

the convenience of the parents, which, while doubtless of considerable advantage to them, is at least open to argument as a function of an educational body dependent upon the rates and State aid.

In the conditions given for a competition for an Elementary School recently built at Manchester, the numbers being 2,000, the proportion of infants was estimated at one quarter. A school at Birmingham recently erected for 1,000 has accommodation for 470 infants, but in this case (see Fig. 292) there are two class-rooms dividing the upper school from the Infant Department which are used in a way as a transition form, and can serve either for the older school or the Infant Department as may be desirable. On the whole the plan of estimating the number of the Infant School at half the other two combined seems the most reasonable.

Number of Storeys.—There is no doubt that the less the number of storeys in a school building the better; but exigencies of site and the effort to supply good playgrounds make it essential that schools erected in London and other large towns should take up as little room as possible. Hence the usual type of building of the London School Board, which consists of three storeys corresponding to the three departments. In the country towns, where School Boards have been able to secure large sites, it is not uncommon to find buildings with all the accommodation on the ground; and there is little doubt that where this can be done, the result is very satisfactory. Where there is no pressure on the available space, it is usual to find the Infant School in a separate one-storied building, either standing adjacent to the school for older scholars or connected with it.

The Size and Number of Class-rooms required.—The size of class-room that is to form the standard is of importance. It is not uncommon to find schools with all the rooms of one size, say to accommodate 60. This generally results in a waste of space, as the upper classes are sure to be smaller than those lower down the school. While it is still not uncommon to find class-rooms capable of holding 70 or 80 scholars, it is becoming recognised now that one teacher cannot deal effectively with more than 60.* The London School Board in their newer schools provide class-rooms of varying sizes to suit the different forms in the school, taking say 40, 50, and 60 pupils respectively.

The area of floor space that has to be provided is laid down by

* See on this, page 102.

the regulations governing building issued by the Board of Education* at 10 sq. ft. per head, and whether sufficient or not, practically all the Elementary Schools are calculated on this basis. For the question of lighting, desks, &c., see Chapter VII.

A certain number of adjacent class-rooms, separated by sliding partitions,† are generally considered useful, though it is now common to find schools with no provision of this kind. In Germany this arrangement is not made use of. The London School Board no longer put them in their new schools, as they consider every class complete with their own teacher. This is also the case with the Board School mentioned above at Birmingham, where every class is completely separate (see Fig. 292). At Manchester, however, this plan has not been adopted, and sliding partitions are found (see Fig. 287). In the plan shown in Fig. 295 of the Great Horton Board School at Bradford there is a large double class which can be thrown into one, as also at the Campsbourne Schools, Hornsey (see Fig. 284).

The hall or assembly room, which may fairly be considered an indispensable adjunct to any school, though all authorities do not seem even yet agreed as to this, is not reckoned in the accommodation, except in the case of an Infant School. In the newer buildings of the School Board for London, which has devoted considerable attention lately to the question of the most economical method of grading the class-rooms, there is always in each of the two departments of the school for older scholars at least one room for not more than 40, the others being between that number and 60. Taking a department at 516, which, as mentioned above, is considered by the London School Board as a maximum size, the rooms would probably be arranged thus :—

Say 1	class-room	for 60	- - - - -	60
4	„	„ 56	- - - - -	224
4	„	„ 48	- - - - -	192
1	„	„ 40	- - - - -	40
				516

The hall being about 55 by 32 ft.

This would be repeated on two floors, the arrangements for the infants also being somewhat similar.

In the case of a mixed school, the hall is generally on one floor only, and has consequently to be very much larger, so as to take the whole school, unless of course a separate one be supplied for each sex.

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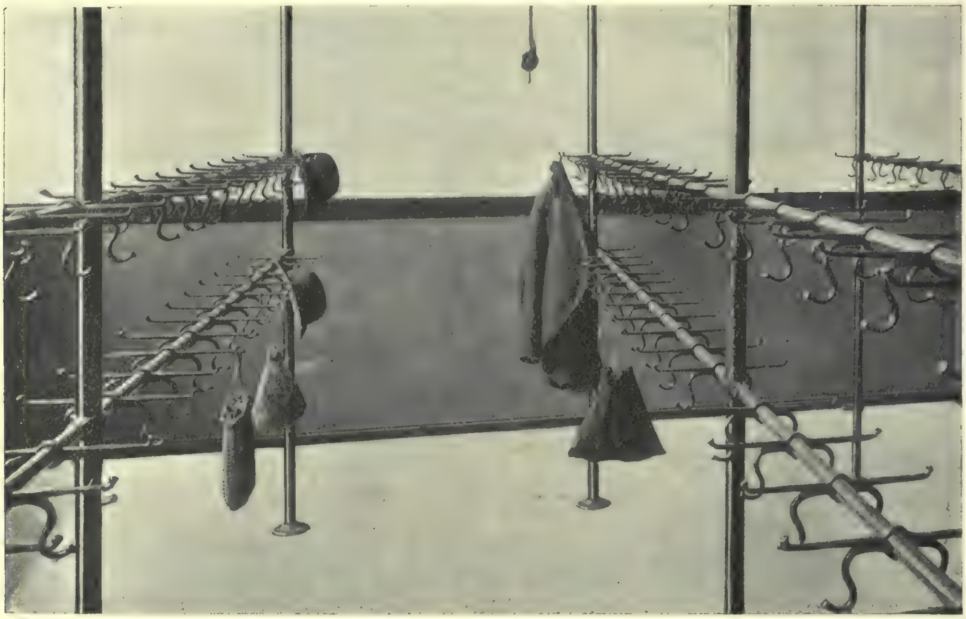
* See Appendix A. † For description of partitions see *ante*, page 100.

The above arrangement is based upon the assumption that every class has a fully qualified teacher in charge of it and a room to itself. When we come to smaller schools, and schools in which pupil teachers are employed to any considerable extent, the arrangements are necessarily rather different.*

Other Rooms.—In addition to the class-rooms and hall there will be required for the ordinary Public Elementary Schools, cloak-rooms for each department and for the mistresses, a room for the staff and head teachers. This is variously arranged. In small schools there is



275. THE "SCHOLA" CLOAK AND HAT STAND.
From a photograph supplied by Messrs Brookes & Co.

generally only one room supplied, which is shared by the assistants and head teachers. In larger schools there may be a room for the female teachers, and another for the masters. A room for the head teacher as well is sometimes supplied. A very common method of getting sufficient room is to place these rooms on a mezzanine floor. In the Girls' Department it is necessary to provide lavatory accommodation for the teachers and for the pupil teachers, the school conveniences being always situated in the playground. Washhand basins

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* See page 364.

are commonly placed for the children's use in the cloak-rooms. One or more store-rooms have also to be provided.

In arranging the cloak-rooms in an Elementary School it is important that plenty of space should be allowed all round the stands which carry the pegs, so as to allow plenty of room for the evolutions of the sort of cloak-room drill that is in vogue in many schools—that is to say, it is common to form the school up in line by classes, each of which in turn, in single file, pass into the cloak-room at one door, pass

276. PART OF THE CLOAK-ROOM, BIRCHFIELD ROAD SCHOOL, LIVERPOOL.

From a photograph supplied by Messrs Brookes & Co. *Willink & Thicknesse, Architects.*

round the stand, and depositing their hats and cloaks on the pegs as they go, emerge by the other door. In case only one door is provided, the two streams pass in the doorway. The discipline of an Elementary School generally involves a number of these kind of marching evolutions, which should not be lost sight of in the planning. The subject of cloak-rooms has already been treated* with regard to Secondary Schools. The fittings in an Elementary School are simpler.

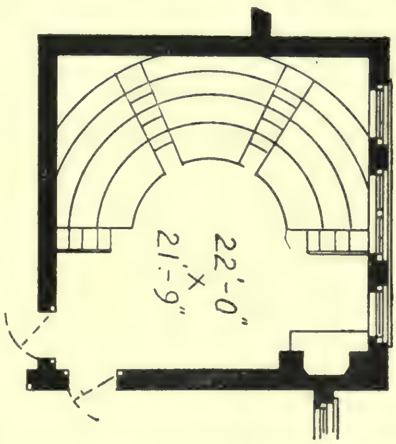
* See page 151.

They should if possible be so arranged as to prevent the clothes touching. A useful and sanitary form of stand is shown in Fig. 275. This has been recently adopted in several large schools in the North of England. The pegs are arranged that they hold the coats and hats in such a way as to allow a free circulation of air round them. These stands are made of great strength and are practically unbreakable. A further development of this sort of stand is shown in Fig. 276, which illustrates part of the cloak-rooms in the Birchfield Road School, Liverpool, recently finished. In this case the stands are filled in with wire netting, which, while allowing of free ventilation prevents caps being thrown about, or entrance by unauthorised persons.

The class-rooms, halls, cloak-rooms, and teachers' rooms may be considered the minimum accommodation necessary for an Elementary School. Further rooms are occasionally found, such as a properly lit studio in which to teach drawing instead of the class-room, a room for manual instruction, and in London some schools have accommodation for teaching cooking or laundry work, or carpentering for boys. Schools having this additional accommodation are often used as centres, and classes come to them from neighbouring schools for instruction in such subjects, for which they have not the necessary facilities. Chemistry and Natural Science are also taught in the Elementary Board Schools by a system of peripatetic teachers, who take their apparatus round with them in order to show the necessary experiments; each such teacher visiting a number of schools at regular intervals, the class teacher as a rule going over the work again, without of course doing the experiments. This rather makeshift method of teaching science is perhaps the only way in which it can be managed under existing circumstances, as science rooms are not yet, as is usually the case in Germany, found in our Elementary Schools. The Higher Elementary Schools, or as they are called, Higher Grade Schools, are provided with excellent and well-equipped laboratories, which are described when dealing with that class of school.

Infant Schools.—The plan of having Infant Schools forming a department of an Elementary School, and regularly found in connection with them, is peculiar to this country. In Germany the Elementary Schools take their children at six, and do not consider them until they have reached that age. There are, however, institutions which more or less correspond to our Infant School, founded usually by the benevolence of private persons, under the somewhat tremendous name of Kinderbewahranstalten, though they perhaps correspond more to the

French crêches. In this country the children are admitted to school at the age of three, having to attend compulsorily at five, so that special accommodation has to be provided for them. In the case of a school in which all the departments are contained in one building it is usual to find the ground floor given up altogether to the Infant Department. Where the site will allow of such an arrangement, the tendency now is to place the Infant School in a separate one-storied block. In country or village schools, where the buildings are as a rule of one storey only, it is usual to find for the infants a separate building, which takes the form of one large room, with a gallery to hold perhaps 60 infants, usually placed in a projecting part of the building, partly to keep as much clear floor space as possible, but more particularly to get a good light from the sides.* In addition to the large school-room it is necessary to have a class-room for the youngest children, known usually as the babies' room. This room is fitted with a gallery which sometimes conveniently takes a semicircular form (see Fig. 277). Where the Infant School is of any size, say 150, another class-room will be necessary for the older class.



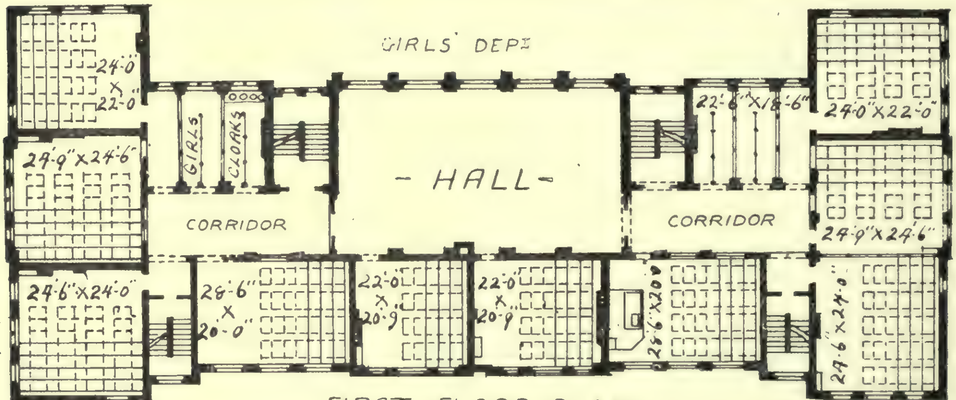
277. A Babies' Room.

This sort of arrangement for an Infant School, *i.e.*, the big school-room with the gallery at one end, has been in recent years, at all events in the larger schools, given up, and the modern Infant School has little to distinguish it from that of the school for older pupils, consisting also of a hall with class-rooms opening off it; practically the only difference being the babies' room with its gallery, the smaller seats, and the special form of desks. See Figs. 283, 291, 294, which show the Infant Schools in separate buildings.

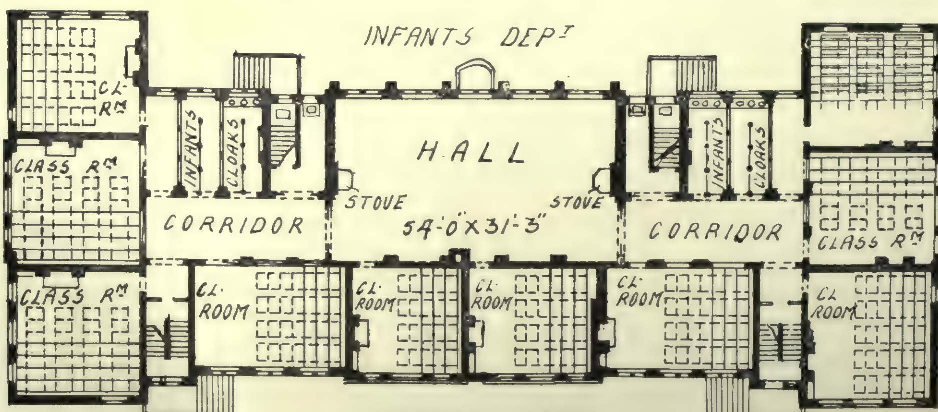
EXAMPLES OF LARGE ELEMENTARY SCHOOLS.

The Cobbold Road School, Chelsea.—The plan given in Figs. 278-280 will show how the rooms may be arranged. This example may be considered a typical plan of the modern Elementary School as built by the London School Board. It will be noticed on looking at the plan

* For examples of Infant Schools see Robson, School Architecture, pp. 181-184.



FIRST FLOOR PLAN
SECOND FLOOR SIMILAR FOR BOY'S DEPT



GROUND PLAN

278-280. Cobbold Road School.

The London School Board. *T. J. Bailey, Architect.*

that none of the class-rooms are provided with sliding partitions so that two rooms can be thrown into one for any purpose.

The cloak-rooms are conveniently arranged immediately at the top of the stairs, and are divided into two halves, each 4 ft. 6 in. wide, with a stand down the middle. At the end are placed the lavatory basins, allowing two basins to every hundred children.

The class-rooms in this school are fitted, as in all the schools of the London School Board, with dual desks, the last three rows being

281. The Campsbourne Schools, Hornsey. Boys' and Girls' Department.
H. Chatfield Clarke, Architect.

raised. The rooms are all excellently lit, the light being brought in from one side only.

Under the Girls' Department, and arranged on much the same plan, is placed the Infant Department (Fig. 278), on the ground floor, so that there should be no steps.

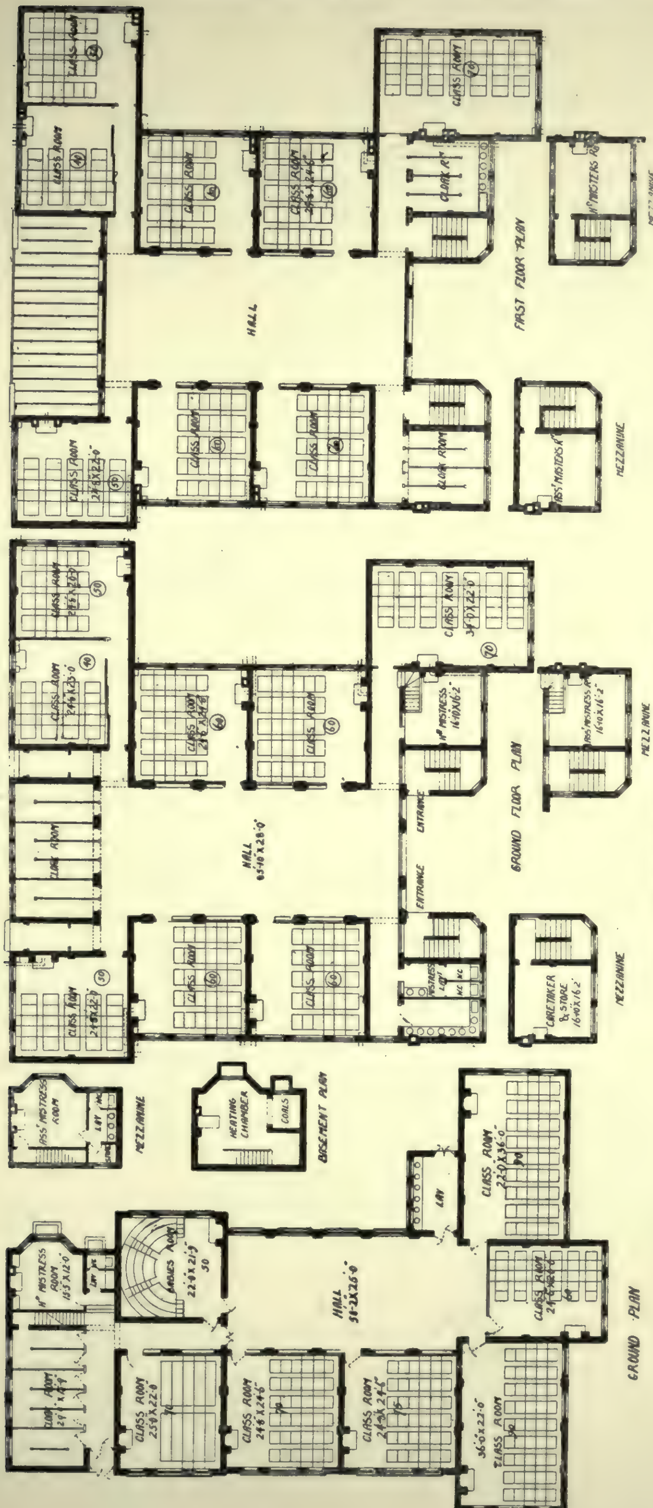
The Campsbourne Schools, Hornsey.—As an example of a two-storied building with the Girls' Department on the ground, and the boys' on the first floor, with the infants housed in a separate building, the schools recently erected by the Hornsey School Board will

serve as an excellent example. These schools are known as the Campsbourne Schools. The site available for the school contained an area of slightly over 2 acres, and the number of children to be provided for 1,400. The Board, on the advice of the architect, Mr Chatfield Clarke, after going carefully into the question, decided that the school should be built in two blocks, one for the girls and boys, and the other for the infants, it being somewhat cheaper to build on this plan, in addition to the advantages gained by limiting the building to two storeys. The accommodation was settled as follows:—Boys, 450; girls, 450; and an Infant School of 510. The class-rooms are of different sizes, viz., one for 40, two for 50, four for 60, and one larger room capable of taking 70. These are exactly

282. CAMPSBOURNE SCHOOLS, HORNSEY. Infants' Department.

repeated on the floor above. On referring to the plan (Figs. 284, 285), it will be seen that these rooms are in each floor arranged on the two sides of two spacious halls, one above the other, measuring nearly 86 by 28 ft. That on the ground floor is lit from the ends, and also by borrowed light from the class-rooms.

The girls' cloak-room is placed close to their entrance, with three openings into the hall, while the boys, whose entrance is at the opposite end of the building, find their cloak-room immediately at the top of the stairs, in which are placed also the lavatory basins. The boys' entrance is in a different street to that of the girls, an excellent plan if the site happens to abut upon two streets. On one mezzanine floor are provided two rooms for the assistant teachers, as well as one for the Headmaster. A second mezzanine floor between the



Boys' and Girls' Department.

Infants' Department.

283-285. Campsbourne Schools, Hornsey.

The Hornsey (U.D.) School Board.

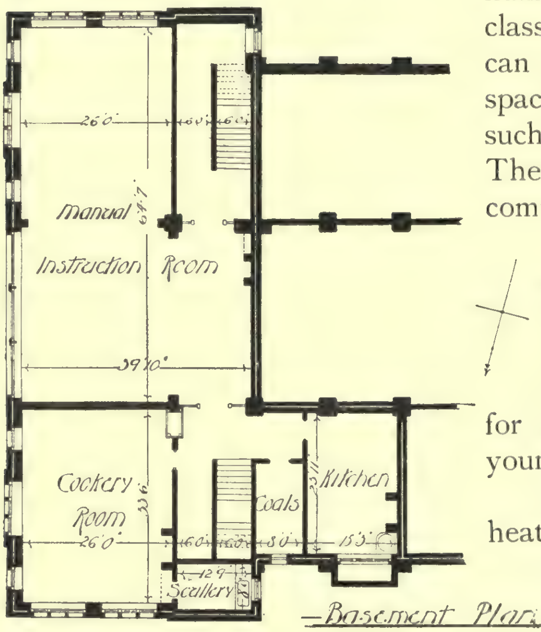
H. Chatfield Clarke, Architect.

ground and first floor gives a caretaker's and a store room. The hall on the first floor has been constructed with an open timber roof which adds much to the handsome appearance of the school.

The class-rooms are fitted with dual desks having the last three rows raised, and are most carefully and excellently lit, every room being lit from one side only, with an ample provision of glass area. They also receive a diffused light from the hall, there being glass partitions carried right along. It will be seen that the two class-rooms at the south-west corner can be thrown into one large room.

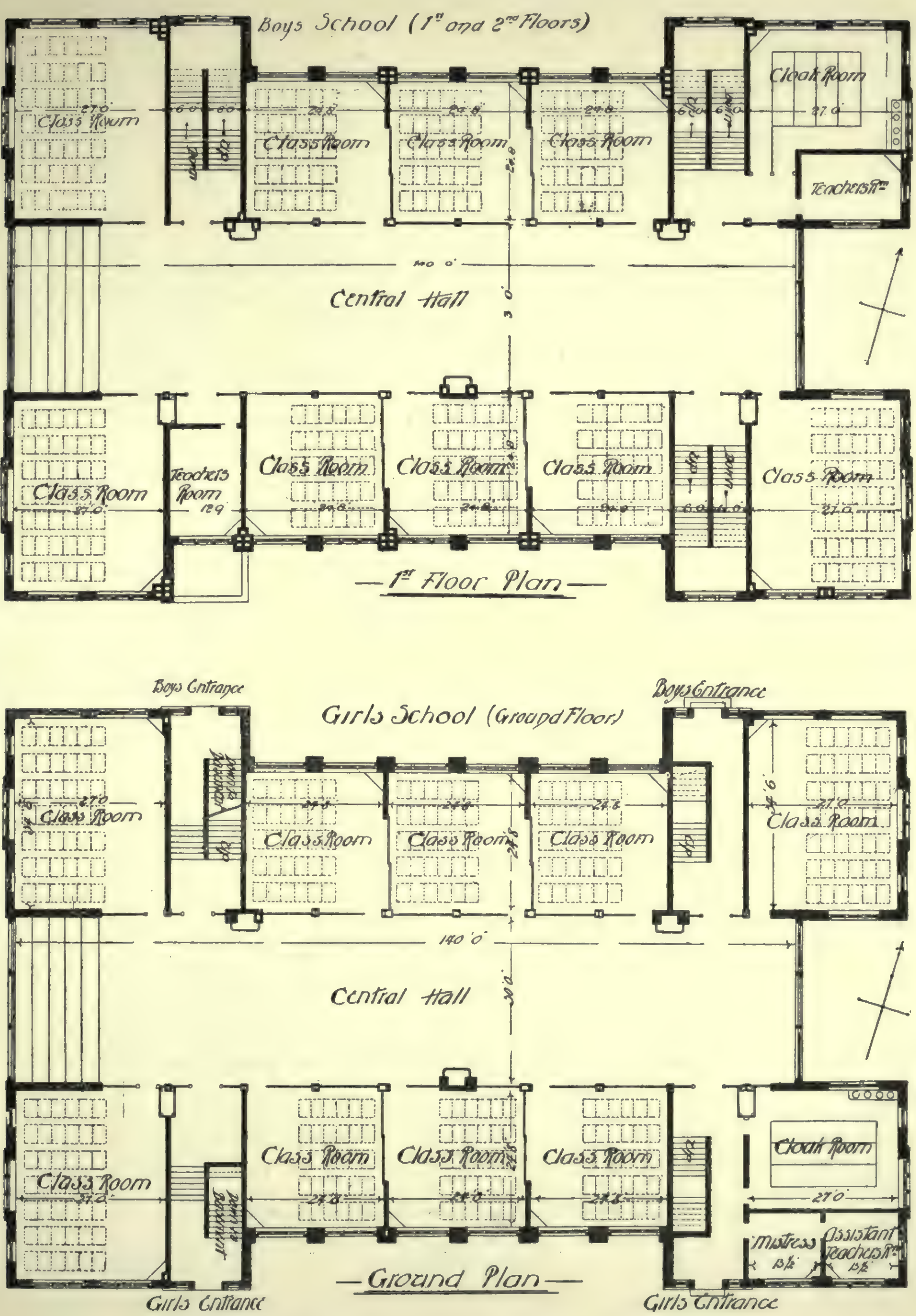
The Infants' Department (Figs. 282, 283) has a hall of 50 by 25 ft., which is in addition to the class-room accommodation for 510, the number to be provided for. One class-room at the end of the hall can be thrown into it if additional space is required for any purpose, such as marching exercises, &c. There is the usual cloak-room accommodation, and two staff-rooms—one for the Headmistress, and one for her assistants. A feature that should be noticed is the provision of a babies' room, with circular raised seats, for the purpose of teaching very young children.

The class-rooms throughout are heated with "Boyd's" patent hot-air stoves, and the halls and corridors by a low-pressure hot-water apparatus, each class-room having a fresh air inlet and an extract flue. The walls internally are built to the height of the dado of brown salt-glazed bricks, the upper parts being finished with buff-coloured bricks. The outside walls, built of stock bricks with red brick dressings, make a pleasing and effective exterior (see Fig. 281).



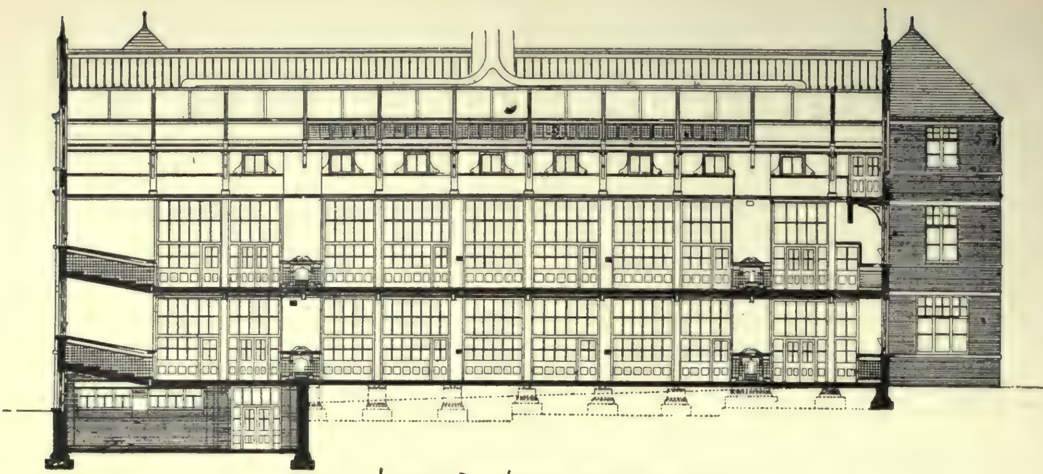
286. THE VARNA STREET SCHOOL.

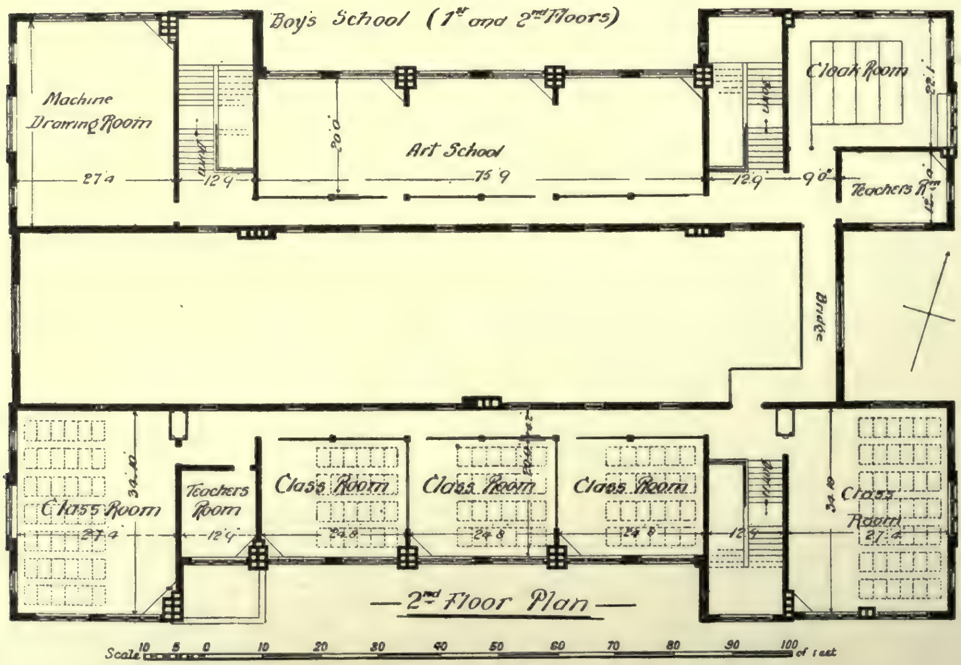
The Varna Street School, Manchester.—This is another good example of a school with a separate building for the Infant Department, and a block for the upper school, with the girls on the ground floor and the boys above, but with the addition of an extra floor containing rooms for drawing and manual instruction. This is a school recently erected by the Manchester School Board, and presents several points of interest.



287, 288. THE VARNA STREET SCHOOL, MANCHESTER.

The Manchester School Board. *Potts, Son, & Hennings, Architects.*





289, 290. THE VARNA STREET SCHOOL, MANCHESTER.

The school was built from designs by Messrs Potts & Hennings, as the result of a competition in which some five or six architects took part. The conditions were very fully and carefully drawn up by the Clerk of the Manchester School Board, Mr Wyatt, who was good enough to take the writer over the building. The result is an interesting and very successful school, one of the most remarkable features being the very low cost of the building.

The accommodation to be provided was as follows:—School to be for 2,000, viz., 1,500 in the upper school, and 500 infants in a separate building.

The rooms supplied in the larger building are—

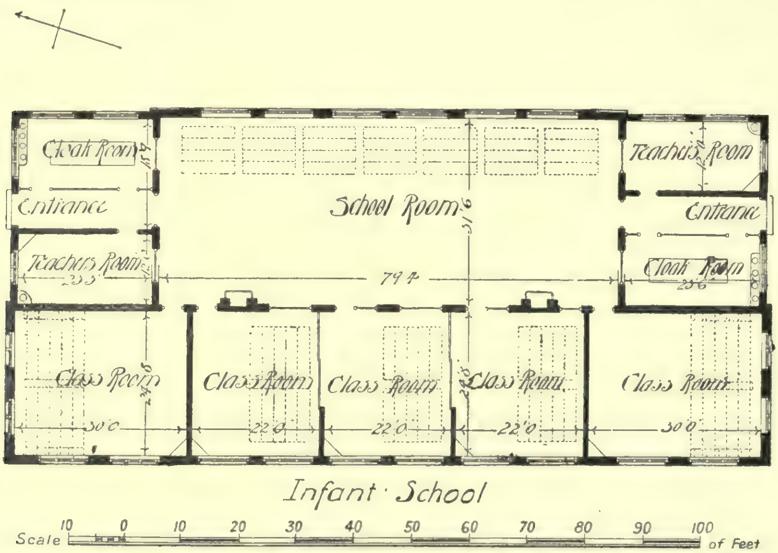
Fifteen class-rooms to hold 60 children.
Eight class-rooms to hold 84 children. These are capable of division by partitions.
Two halls, 140 by 30 ft.
Three cloak-rooms.
Four teachers' rooms for heads and assistants.
Large drawing school.
Room for machine drawing.
Manual instruction room.
Cookery instruction room.
Caretaker's room and coal-rooms.

It will be noticed that there are here given several rooms not found in the other two Elementary Schools of which plans have been given, but which ought if possible to find a place in every school in this country, as they usually do in a German School, for while in London it may be possible to give instruction in certain extra subjects by sending the children to various centres, it is very often, and especially in country places and towns, a matter of great difficulty, and in any case it is a great advantage to have facilities for doing so in the school itself.

The way in which the building is arranged can be seen on reference to Figs. 286-290, where the full plans are given.

The first point that draws attention on looking at the plan is the entire absence of internal walls in the main building. All the class-rooms on the two sides of the hall are merely shut off by glass and wood partitions, the glass running from 3 ft. 6 in. right up to the ceiling (see section, Fig. 289). The hall is of great length, viz., 140 ft., and the entire width of each end is taken up with the window. The side walls of the class-rooms, except for the constructionally necessary pier, are plain glass. The result of this, looking down the long hall, is very striking. The whole building is warmed entirely by open fire-

places, formed with "Leamington bars," there being no form of heating apparatus in the building. As the school stands in a high open position, with an unusually large area of glass, it is difficult to believe that they do not suffer from cold in the winter. However, the Headmaster stoutly maintained that the rooms were most satisfactorily warm in any weather, and that as a rule he had only one of the three fireplaces in the central hall lit, because fires near the exits were only apt to make the boys stand about by them, and moreover were not usually wanted for heating purposes. As I was at the school in the early summer, I had no opportunity of judging personally, but could not help thinking that the children of Manchester must be unusually warm-blooded.

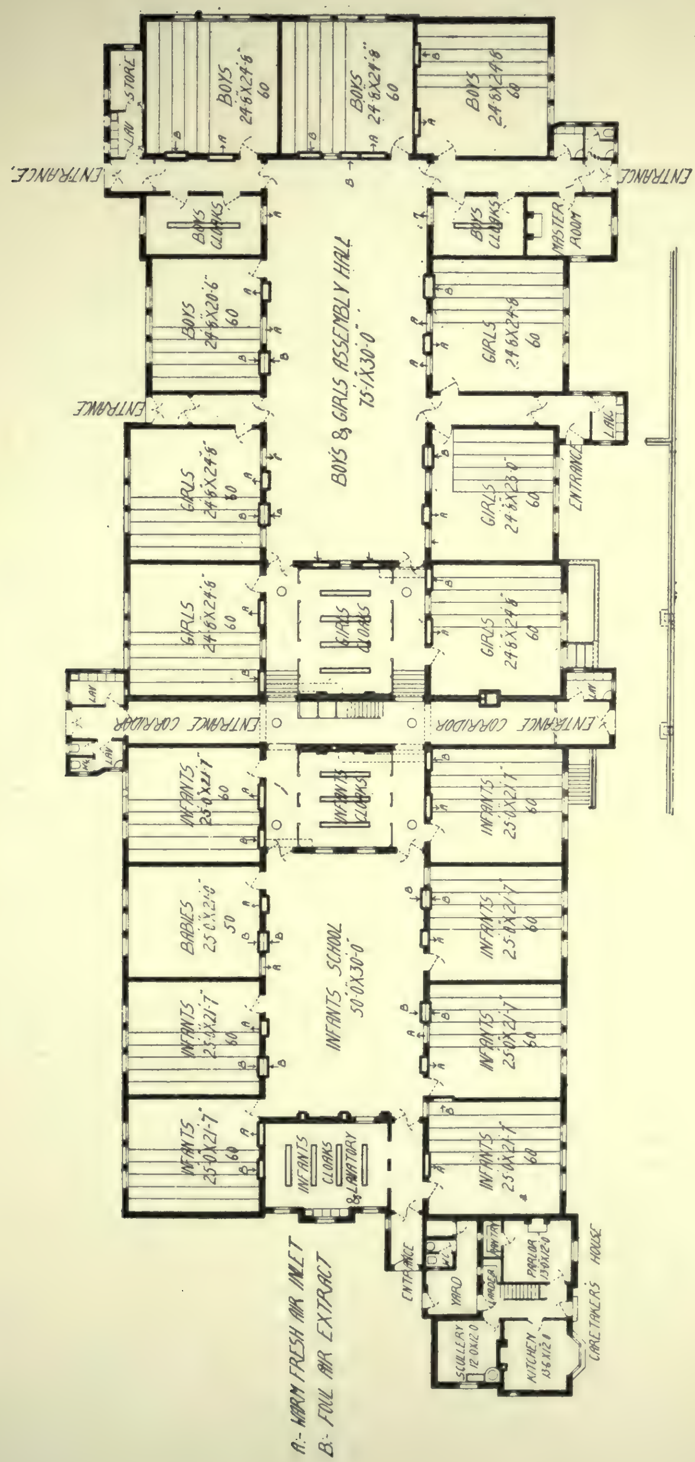


291. Infants' Department, Varna Street School, Manchester.

The class-rooms are so arranged that of those in the central block any two can be thrown together in a moment if it is desirable for one teacher to keep an eye on two forms. When the partitions are pushed back, about two-thirds of the dividing partition is clear.

Dual desks are employed, and the area of floor space allowed is 10 sq. ft. The Infant School, placed in a separate block, is shown in Fig. 291, arranged with rooms on three sides of a hall.

There is in every class-room a ventilating extract flue, as there is also to the cloak-rooms. There are, however, no inlets, but the open fires no doubt assist the ventilation. The upper parts of the windows also are made to open easily. The rest of the arrangement of the rooms can be easily seen from the drawings. The idea of the building



292. The Conway Road School, Birmingham.

The Birmingham School Board. *Martin & Martin, Architects.*

is the same as that of a factory, being a skeleton of iron-work and brick piers filled in with glass and wood-work, the result being an effective and thoroughly useful school building, excellently lit, and produced at an extraordinarily low cost. The limit laid down by the conditions for the competition, as mentioned above, was £9 a head, and this sum had to include, in addition to the actual building, draining and concreting of playgrounds, erection of boundary walls, draining of building, offices, cloak-room fittings of wrought iron to special pattern; all school furniture, including three pianos, clocks, fittings for cookery and manual instruction rooms, notice boards, &c.; all necessary waste pipes, meters, gasfittings, &c.; a caretaker's house of six rooms; and £30 for memorial stone. That is to say, the entire cost of the school, ready for occupation, including playgrounds, and as a matter of fact the whole of the main block for the upper school and the infants' building, was completed for little over the sum named. Externally the school presents somewhat the appearance of a factory, but it is a plain and unpretentious building, and if not exactly beautiful, is simple and straightforward.

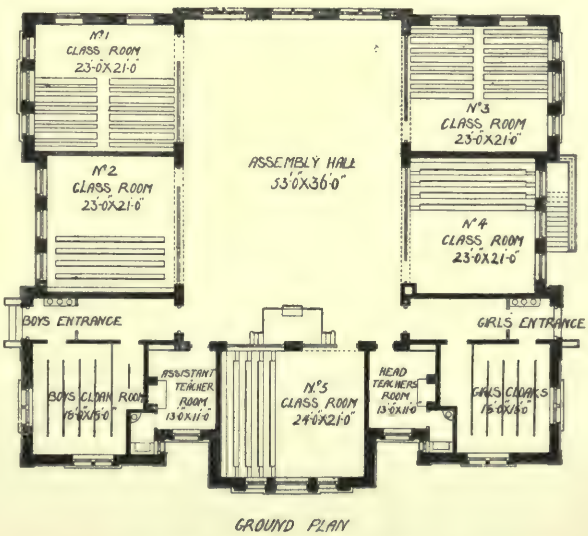
The next type of school is that in which all the rooms required are arranged in one storey only, and there is no doubt that this arrangement is a very satisfactory one, but requires of course a great deal of space.

The Conway Road School, Birmingham.—This is a good example of this class of school recently completed from the designs of Messrs Martin & Martin (see Fig. 292). The school is designed to accommodate 1,050 children, in the proportions 290 boys, 290 girls, and 470 infants. The whole of the school buildings are in one block, including the caretaker's house. The boys and girls have a common assembly hall of 75 by 30 sq. ft., giving an allowance of 4 sq. ft. per head. On looking at the plan, it appears that the Infant School is very large in proportion to the other part of the school; but as a matter of fact the two class-rooms adjoining the older school are used for whichever department it may be found most convenient. The cloak-rooms are particularly worthy of notice. The girls' and infants' cloak-rooms are provided with windows enabling supervision to be kept upon them by any one in the central hall; the sides next the corridor are formed of wire netting, which, while allowing free ventilation, prevents access by the children at unauthorised times. There is a room provided for the Headmaster, but beyond that there is no accommodation for the teaching staff. There are no less than seven entrances to the building, so that in cases of necessity it could be emptied very rapidly. The lavatory basins are arranged in these entrance porches. The warming

and heating of the building is provided for by the method known as the Plenum system, which is referred to and described when discussing that form of ventilation.* The school cost about £18,000.

293. THE GREAT HORTON SCHOOL, BRADFORD.
W. J. Morley, Architect.

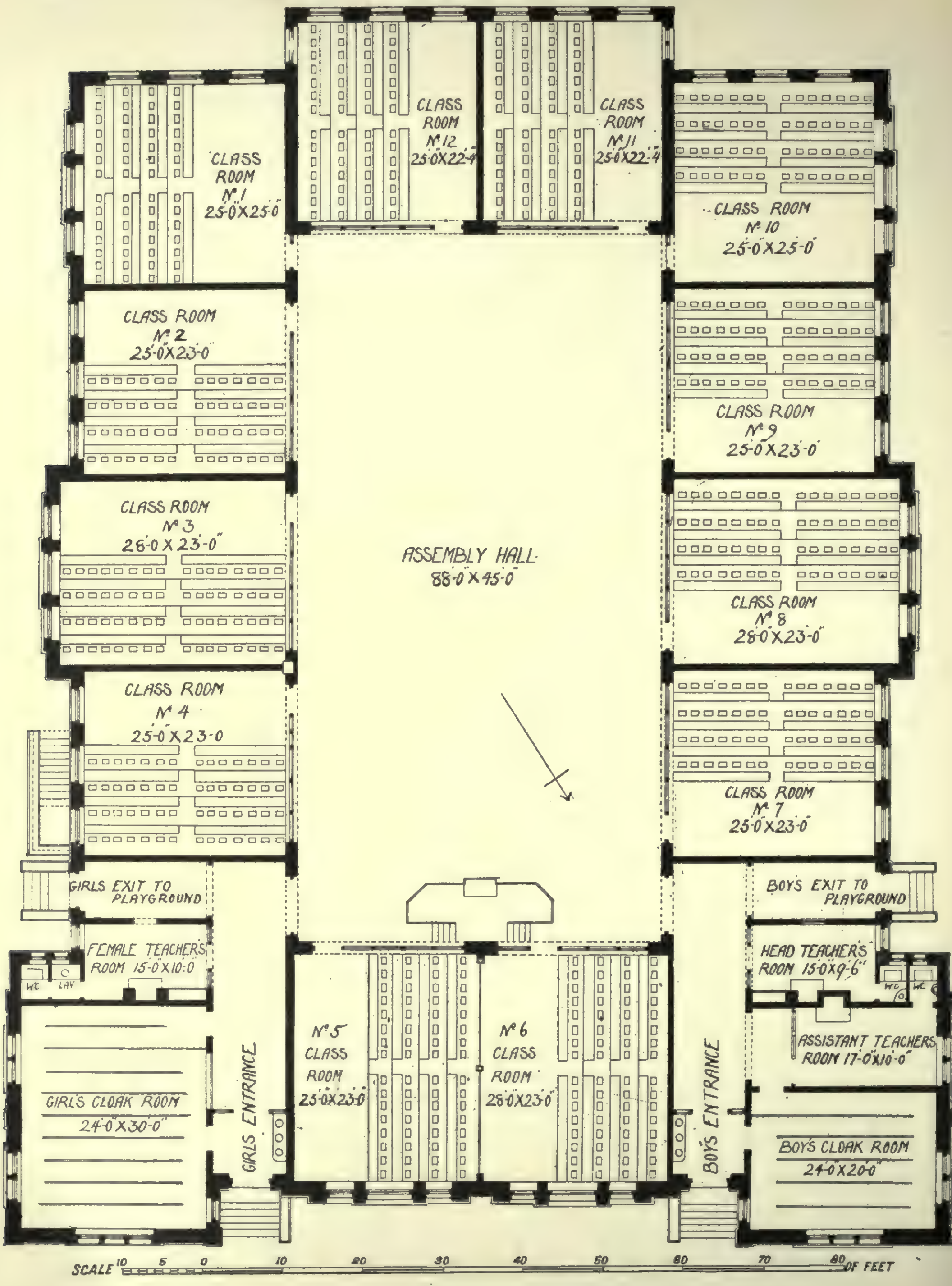
The Great Horton Board School, Bradford.—This is another example of a large one-storied building, with the Infant School arranged in a separate building (see Figs. 294, 295). The upper school is a "mixed" school, and provides accommodation for 704 children. The class-rooms, of two sizes, viz., 56 and 64, are arranged round a central hall, separated by glass partitions from the latter, which is of large size, measuring 88 by 45 ft. This allows rather over $5\frac{1}{2}$ sq. ft. per head. Fig. 294 shows the building for the Infants' Department.



294. INFANTS' DEPARTMENT, GREAT HORTON SCHOOL, BRADFORD.

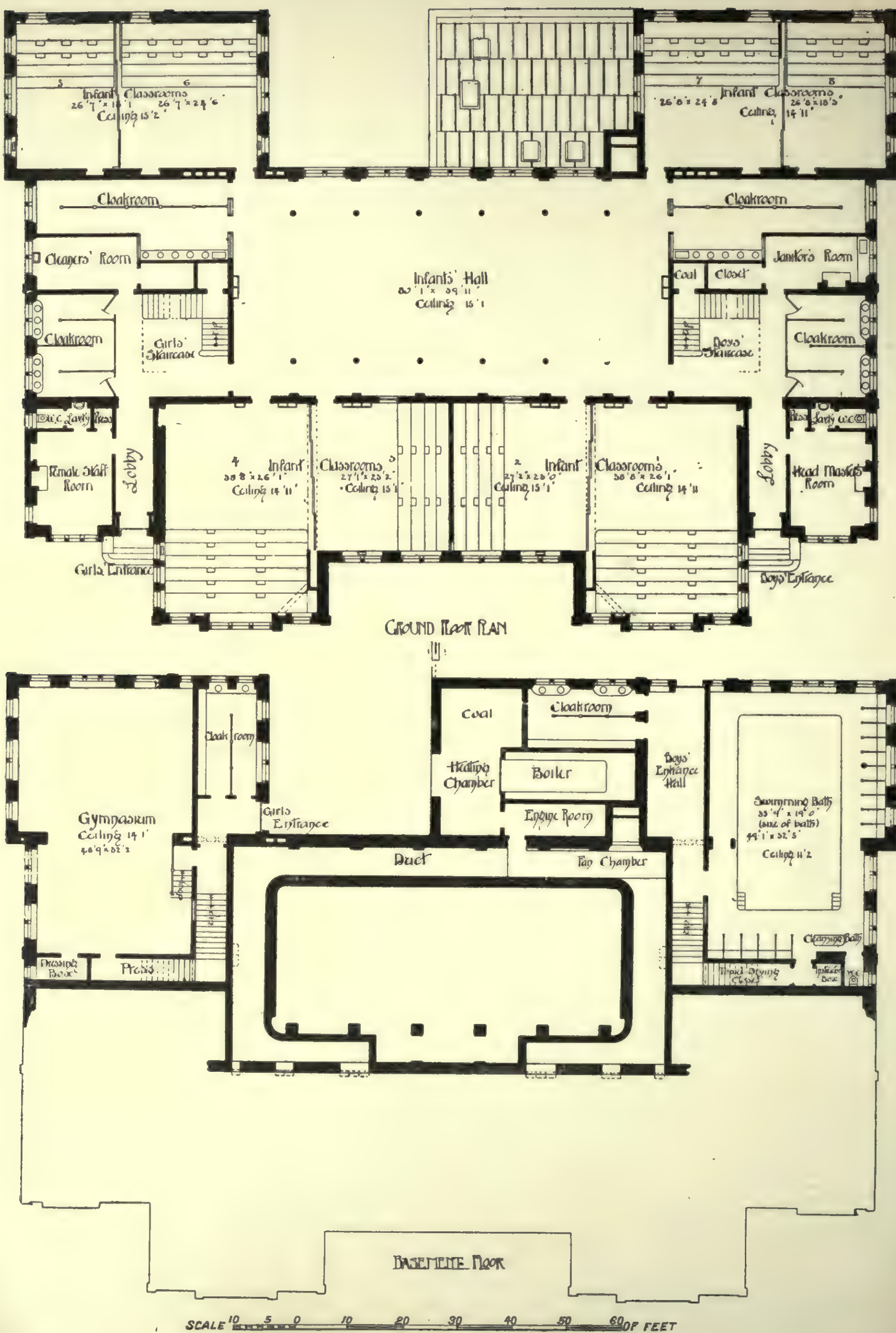
Bruntsfield School, Edinburgh. — Figs. 296-299 show an example of a Scotch Board School. This building, recently erected in Edinburgh, has a novel feature, in a swimming bath situated in the basement of the building, with a

* See page 408.



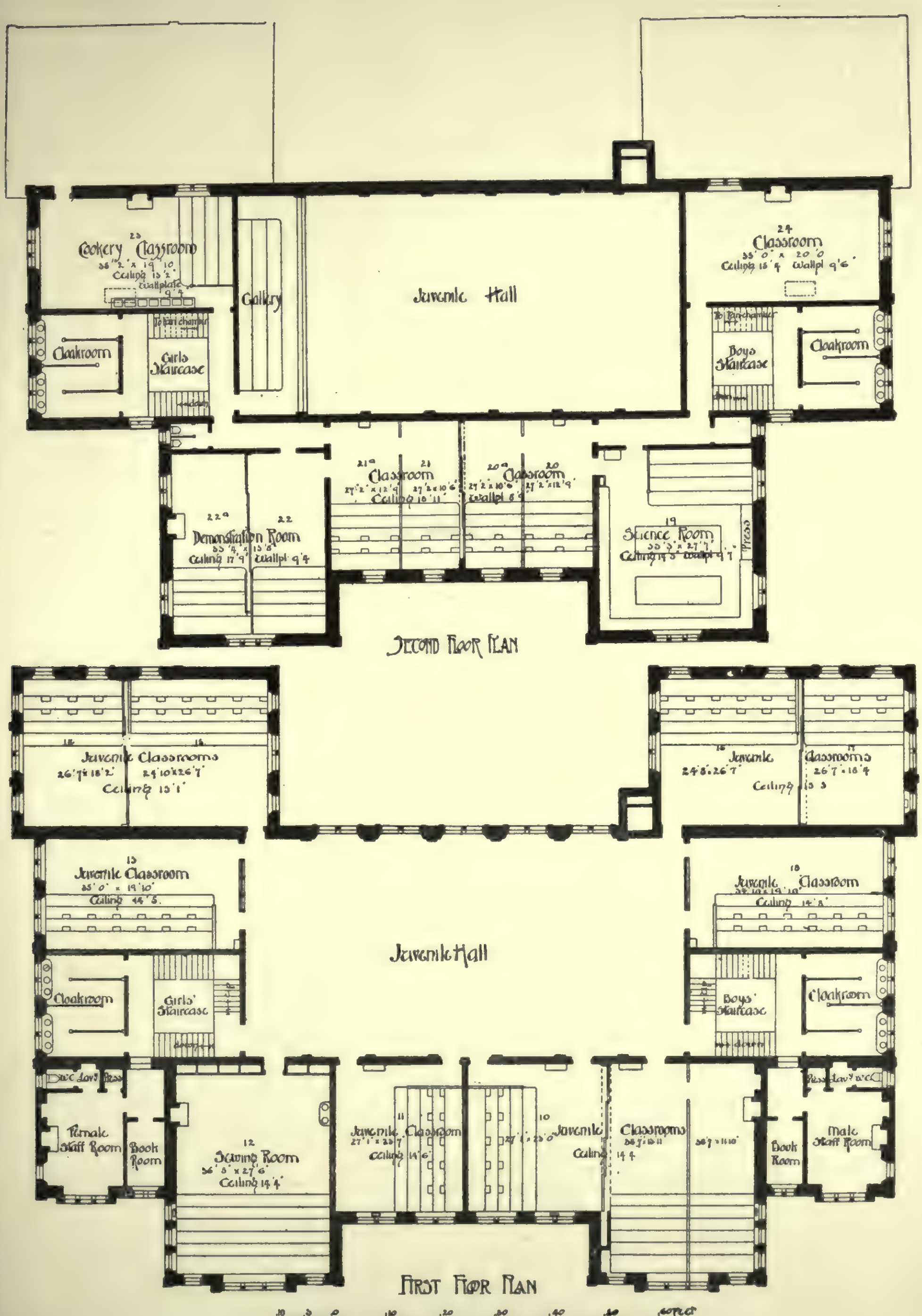
295. The Great Horton School, Bradford.

The Bradford School Board. *W. J. Morley, Architect.*



296-299. THE BRUNTSF

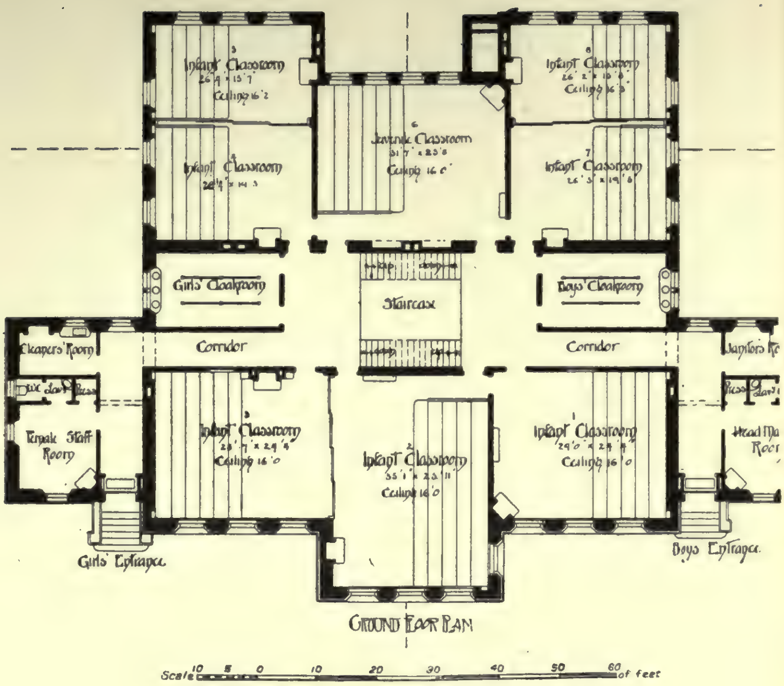
The Edinburgh School Board.



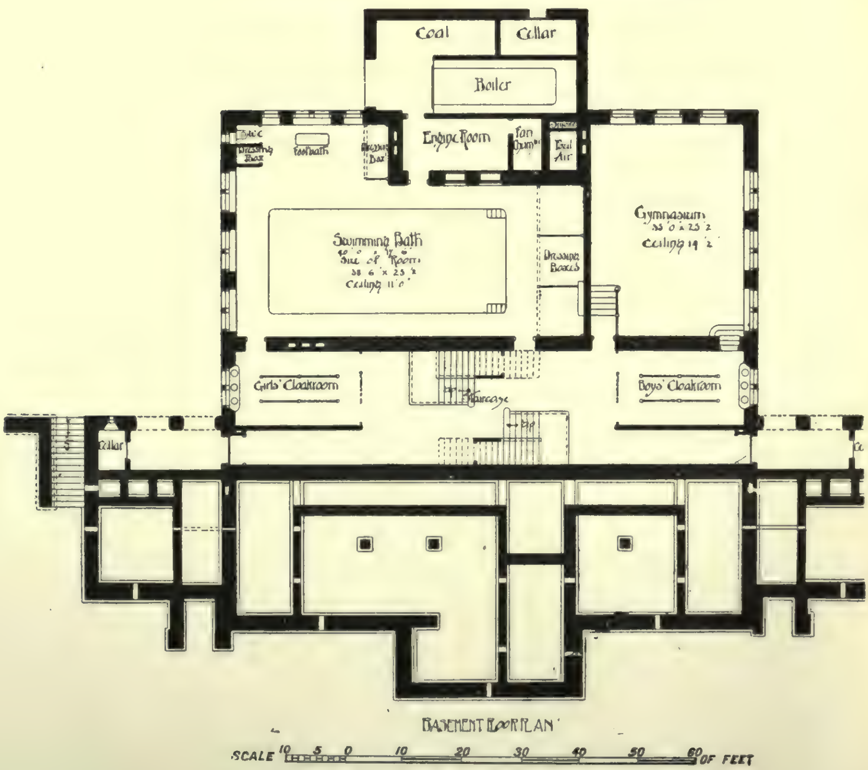
SCHOOL, EDINBURGH.

Robert Wilson, Architect.

Between pp. 338 *and* 339.



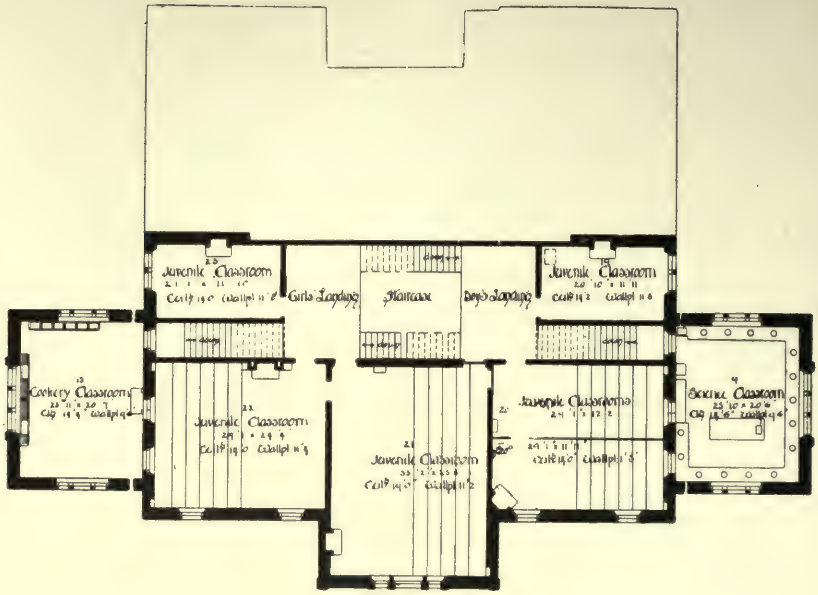
GROUND FLOOR PLAN



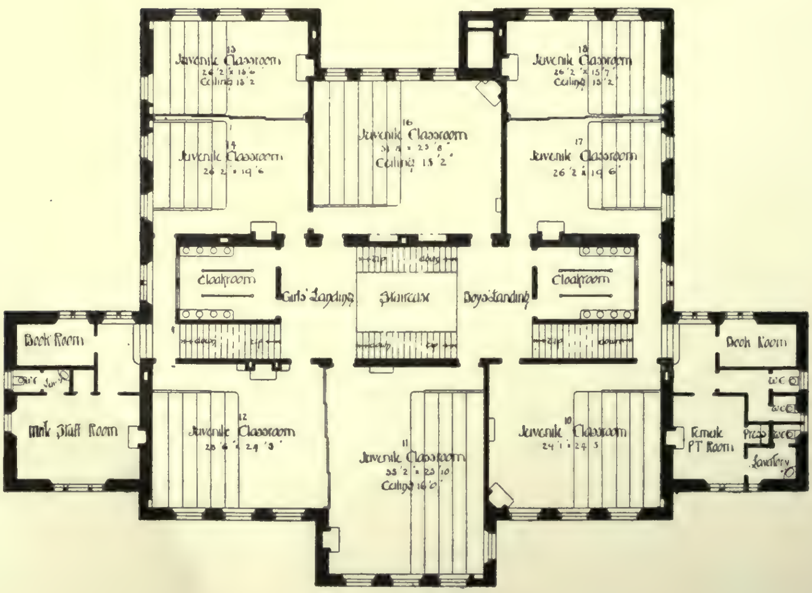
BASEMENT FLOOR PLAN

300-303. THE BROUG

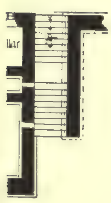
The Edinburgh School Board.



SECOND FLOOR PLAN



FIRST FLOOR PLAN



ITON ROAD SCHOOL, EDINBURGH.

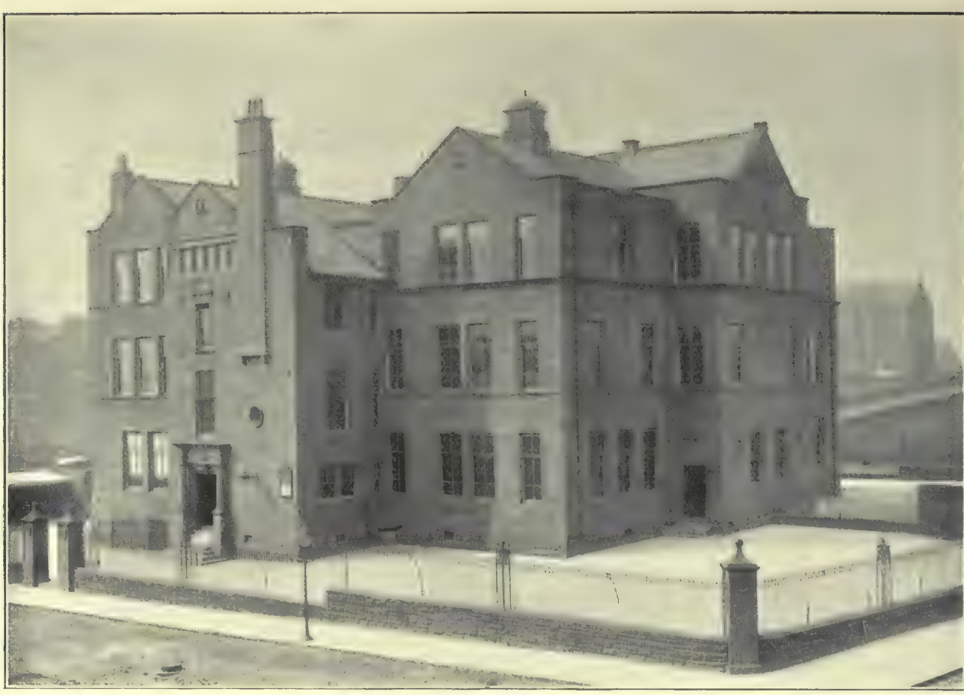
Robert Wilson, Architect.

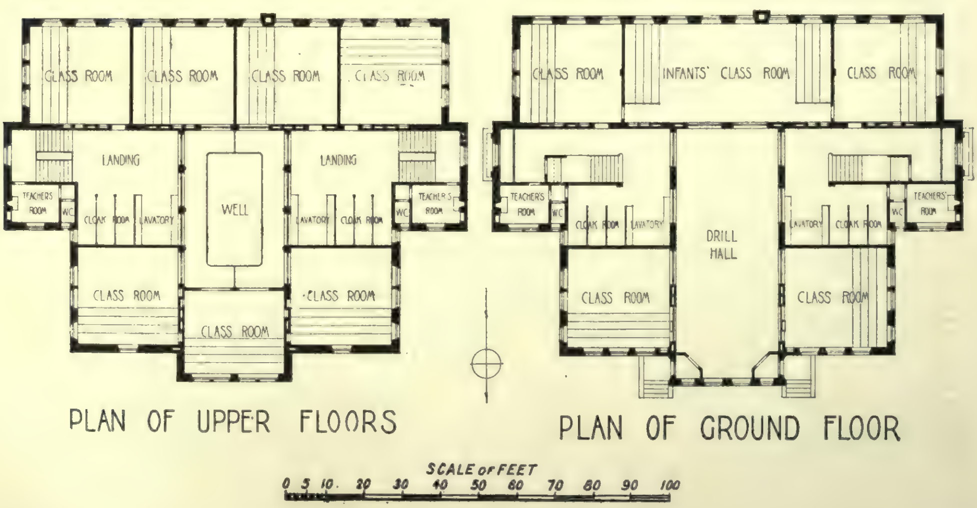
To face p. 339.

gymnasium to correspond with it on the opposite side. This plan for the swimming bath was warmly spoken of by the teachers, but it appears not to have been adopted as a regular plan by the Edinburgh Board, though found again in the school illustrated below, probably owing to the expense involved. The ground floor is devoted to the Infant Department, for whom the hall on that floor is reserved. The rest of the school is mixed, and known as the "Juvenile" Department. They occupy the first floor, while the second floor is reserved for more advanced scholars, being practically a Higher Grade School to which pupils come from all over the neighbouring district. It will be noticed, on looking at the plan of the second floor, that the class-rooms on the front are separated by partitions in order to allow of the necessary division, while facilities are provided for the teaching of science, cookery, &c. The plan of the school is on the whole not unlike that of a London Board School, and provides good and ample accommodation both for the pupils and the staff. Unfortunately the lighting in some of the class-rooms cannot be considered good. This was especially noticeable in the class-room at the south-east corner of the building next to the boys' entrance. This room, both on the ground and first floor, had been divided by a partition (see Fig. 298) into two long narrow rooms with the only light at the back, and the school being very full, the seats were necessarily brought a considerable distance forward, with the consequence that about half the children were in a quite inadequate light. The difficulty had been partially met by introducing a side window high up in the case of the room on the first floor. It should be added that were the seats arranged as shown by the architect, the light would be strong enough, but owing to the increase in numbers in the school, it has been necessary to bring the seats much farther forward. The lighting again of the divided class-rooms on the top floor can hardly be considered to come up to modern requirements.

Broughton Road School, Edinburgh.—The school shown in Figs. 300-303, also an Edinburgh School, has swimming bath and gymnasium in the basement; but in this case it is not provided with a hall, the class-rooms being grouped all round a central staircase, a science class-room and cookery instruction room being provided on the top floor.

Alexandra Parade School, Glasgow (Figs. 304-306).—The plans of this school were sent by the Glasgow School Board to the Paris Exhibition of 1900, as being a typical example of their Elementary Schools. As is usually the case in Scotch Schools, there is not a hall on each floor, access to the rooms on the upper floors being gained by means of a gallery. The cloak-rooms and lavatories are conveniently placed on





304-306. THE ALEXANDRA PARADE SCHOOL, GLASGOW.

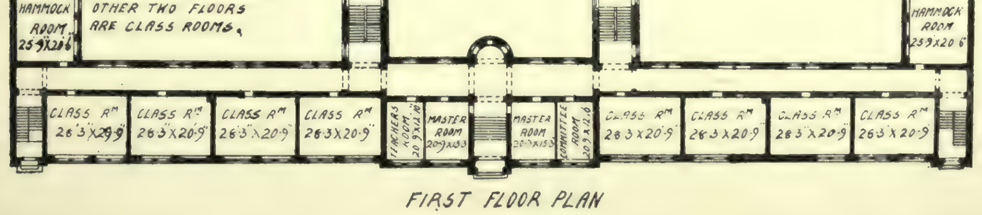
The Glasgow School Board. *M'Whannell & Rogerson, Architects.*

the landings close to the stairs, accommodation for the teachers being arranged off the half-way landing.

All these schools of which plans and descriptions have here been given are typical of a very large number of schools that have been

307. ELEMENTARY SCHOOL IN THE CHRISTBURGERSTRASSE, BERLIN.

recently built all over the country. They are organised on what is called the "class-room" or "Prussian" system, and as the idea of this arrangement was probably in the early days borrowed to a large extent from the Continent, it will be interesting to compare with them one or



308-311. ELEMENTARY SCHOOL IN THE CHRISTBURGERSTRASSE, BERLIN.

two of the more recent German Elementary Schools before passing to different types of buildings. In comparing the plans of the schools in the two countries, it should first of all be borne in mind that the hall in a German Elementary School corresponds in no degree to that found in our

schools. It is there, if found at all, which is by no means always the case, placed on the top floor well out of the way. It is used for examination purposes and social functions, and is often handsomely decorated. But while they have in Germany no assembly halls corresponding to ours, there is always attached to the school a spacious and well-equipped gymnasium, standing as a rule in the playground. The school very often assembles in this for prayers, singing, or work of a collective character. They usually include in their Elementary Schools special rooms for science teaching, if not completely equipped laboratories. They also have in the newer schools elaborate and complete washing and dressing rooms, fitted with spray and shower baths, generally placed in the basement. These will be found fully described on pages 419-422. In Germany, Infant Departments are not found as part of the school. The school age begins at six. Below that the State School does not concern itself with children, though a number of private persons and societies are organising Kindergartens for children under six years of age. Class-rooms with sliding and movable partitions are not found in German Schools. It will be noticed that the German Schools are divided into two corresponding halves for the different sexes vertically, while in this country they are always divided horizontally so as to give a floor to each.

As an example of a large Public Elementary School are given the plans of a large school recently erected in the Christburgerstrasse, Berlin (Figs. 307-311). This is intended to take about 2,000 children. The building has four floors (on each of which the rooms exactly correspond, except in the centre of the building), besides a basement, and contains the following accommodation, arranged on the different floors as follows:—The class-rooms, of which there are thirty-eight, are all the same size, viz., about 28 ft. by 19 ft. 9 in. On the ground floor next the main entrance, which divides the school into the boys' side and the girls' side, the two halves corresponding in every particular, are placed two offices.

To the left of the office, on the left side of the entrance, is the head teacher's room, and corresponding to it on the other a map room. Beyond this on each side are four class-rooms, and in the projecting wings on each side there are two rooms in which the youngest children are put during recreation hours, where they can play under supervision. These rooms are a recent innovation, and are called "Kinderhorte." On the first floor the room over the offices to the left of the entrance is a Natural Science class-room, while the space over the entrance is used as an apparatus room, the remaining nine rooms along the front

being class-rooms. In the two projecting wings are two conference rooms which serve as common rooms for the masters and mistresses respectively.

On the second floor the room to the right of the entrance is taken for Natural Science teaching, with the same arrangement for apparatus, the remaining eleven rooms serving as class-rooms.

On the third floor there are found ten class-rooms, while the three rooms in the centre are combined to form the hall.

In the basement there is a large provision for the storage of coal and the heating apparatus. Here is found also the spray bath arrangements, consisting of two rooms, one serving as a dressing-room, with twenty compartments; in the other are arranged shower baths. Next to it are two drying-rooms, and the heating apparatus for the shower baths. In the two projecting wings are two rooms where all the cleaning apparatus, &c., is kept, and under the stairs in the small projections are found two closets for the masters and mistresses respectively. This list of accommodation omits the large gymnasium, which stands in the grounds at some little distance from the school. See Fig. 273, where a site plan of the school is given.

In considering the accommodation provided, it will be noticed that there is no cloak-room provision. Secondly, that though the teachers' rooms are on the first floor, there is no provision of closets nearer than the basement, and no lavatories at all, either for teachers or scholars.

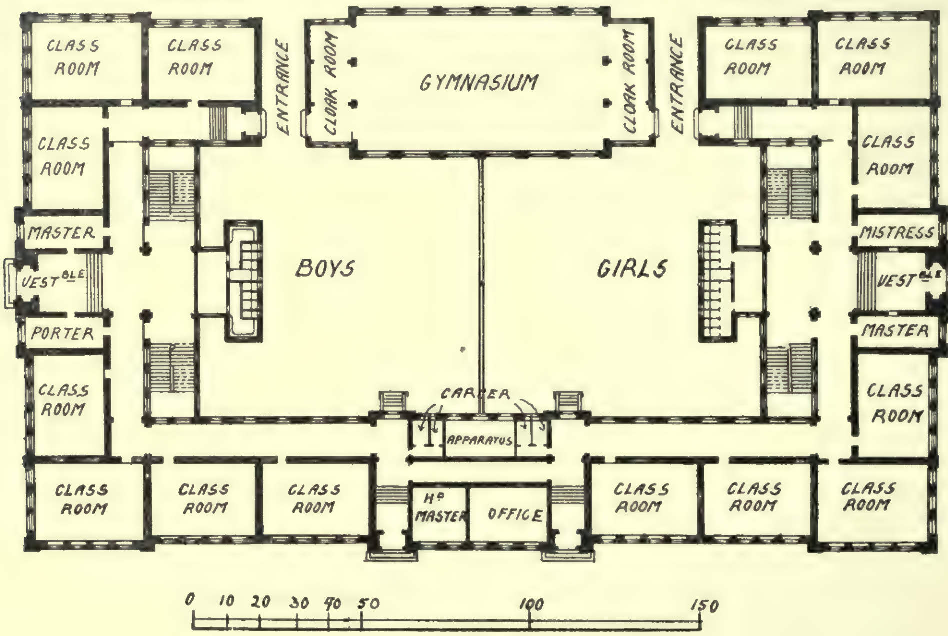
Except for these points, the building is planned on a lavish scale as regards room. The corridor alone, running as it does the entire length of the building on four floors, with width of 9 ft., makes an area of 2,970 sq. ft., which would be equal to a hall of say 73 by 40 ft., or five more class-rooms.

The plan of the building is simple in the extreme, consisting of merely one very long corridor with all the required rooms opening off it. On looking at the block plan (Fig. 273) it will be seen that all the class-rooms, with the exception of two on the third floor, look over the playground. This system of a long corridor with class-rooms opening off it on one or both sides is one very commonly met with in German Schools.

The next example, taken from the "Handbuch der Architektur," shows another arrangement of the corridor system of planning, the building forming a square, so arranged as to include the gymnasium, which serves for both Boys' and Girls' Departments, as is very commonly the case, though in many of the large schools two are supplied, one

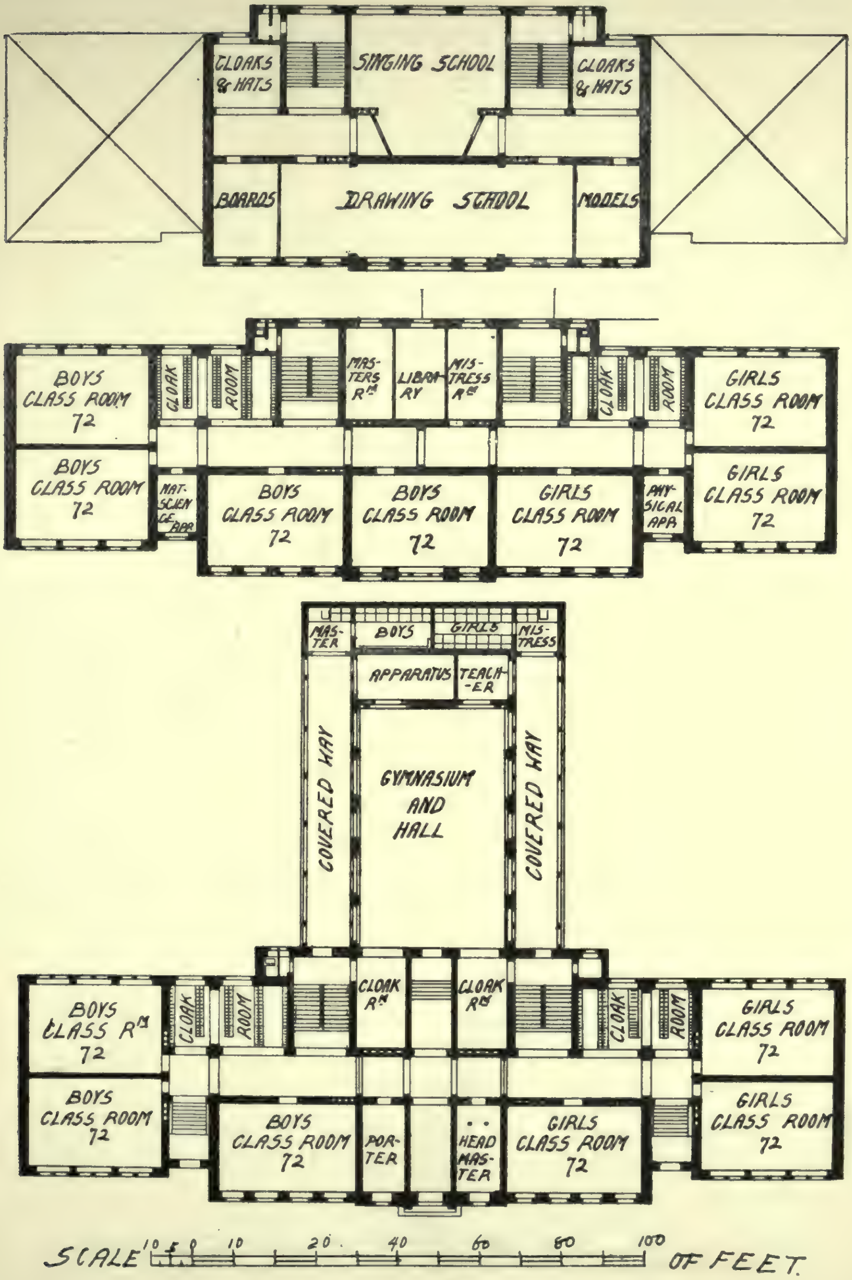
for each department. This school (Fig. 312) is a large Elementary School at Mannheim, and contains seating accommodation for 2,100 scholars, for whom there are forty-two class-rooms, each capable of taking 50 scholars. The gymnasium is of considerable size, measuring 72 ft. by 39 ft. 3 in., having an entrance on each side of it with cloak-rooms. This building was erected in 1887, the architect being Ritter. The school has four carcera or punishment cells, two for each department. These are not apparently used much, and are generally omitted in the more recent schools.

The next example (Figs. 313-315), drawn from a work by H. Reinold



312. LARGE ELEMENTARY SCHOOL, MANNHEIM.

Faber, shows a different type of school. In this case the gymnasium is included in the building, instead of standing away from the main block in the playground—in fact, German School plans may be roughly divided into those in which the gymnasium is separate and those in which it is included in the main building. The inclusion of the gymnasium does not prevent the aula or examination hall being also provided in the accommodation. It is not usual to carry the gymnasium above the first floor. This example presents considerable difference to the foregoing building, and in general plan and arrangement bears more resemblance to an English Secondary School.



313-315. A German Town School.

Reinold Faber, Architect.

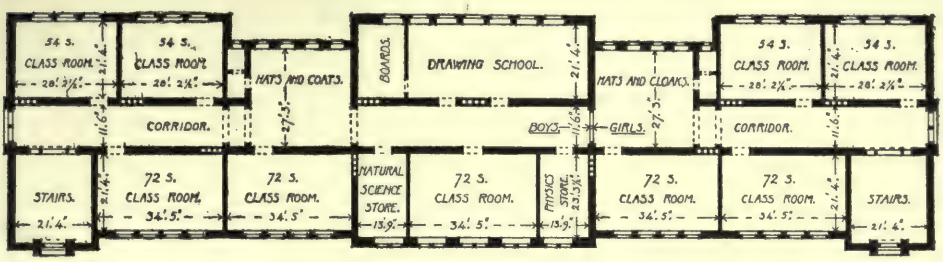
The accommodation is ample and conveniently arranged. This school has, in addition to the rooms given in the building above, a library, serving when required for a conference room, placed next to the masters' and mistresses' common rooms. There are lavatories for both masters and mistresses on each floor off the landings and the stairs. There is also ample cloak-room accommodation. There is no examination hall to this school, the gymnasium answering here both purposes. On the top floor there is a large drawing-school and a singing-room. The latrines are placed at the end of the gymnasium, away from the school building, with which they are connected by two covered ways, one on each side, corresponding to the division of the building into the Girls' and Boys' Department.

There is seating room in the class-rooms for 936 children, each class-room being capable of taking 72 pupils.

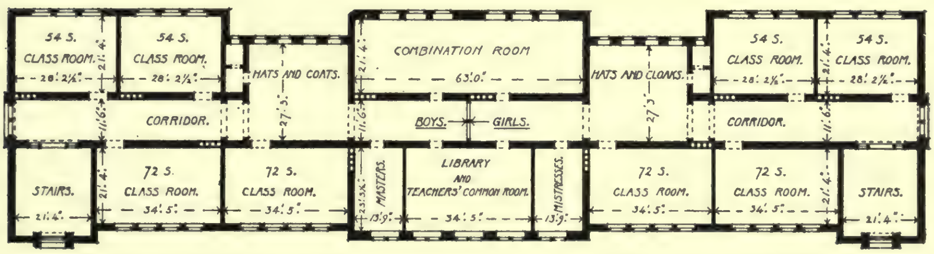
The main entrance of the building leads straight through the handsome vestibule down some steps to the gymnasium. On either side of this are found the Headmaster's room and the office. The pupils' entrances lead directly to the cloak-rooms, which have two entrances on to the corridor down the centre of the building. This corridor obtains its light through the cloak-rooms and from the windows on the stairs. The cloak-rooms are of considerable size, each of them measuring about 27 by 15 ft., and are repeated on the first floor, and on rather a smaller scale on the second floor. At the end of the gymnasium is provided a room for the teacher and another for the apparatus. In the basement are found the caretaker's living rooms, heating apparatus, and coal cellars, also storage room for chairs. On the first floor the space over the entrance in each department is utilised to form a small store-room for keeping the apparatus used in teaching Natural Science. On the whole it is a carefully thought-out and well-arranged school, and except that there are no washing arrangements for the pupils, it is difficult to find anything that has not been provided for.

The next example (Figs. 316-319) shows a somewhat similar arrangement of school, but on a much larger scale. There is accommodation for over 2,000 scholars, the class-rooms being of two sizes, for 72 and 54. The gymnasium in this case is not included in the main block of the building, but lies a little way off, and is connected with it by two covered ways. There is again in this school ample cloak-room accommodation, and the assistant masters and mistresses are well provided for. The accommodation is on a large scale. There is a room for teaching Natural Science with its store-rooms, a large

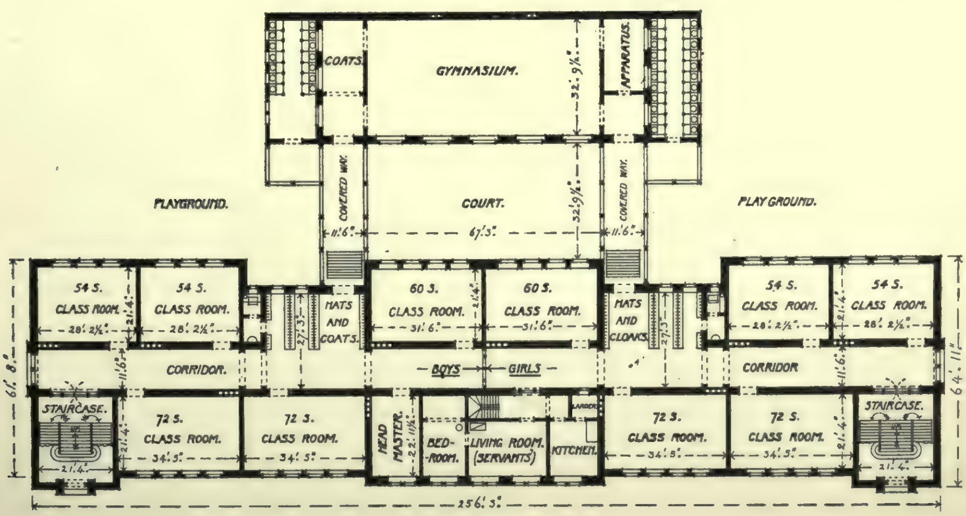
THIRD FLOOR PLAN.



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.



GROUND PLAN.

316-319. A Large Elementary School, Germany.

Reinold Faber, Architect.

hall measuring 63 by 36 ft., drawing-school, singing-room, and a combination room to serve a variety of purposes. We have hardly reached the point in this country where so elaborate and completely equipped a building, designed on such spacious principles, could be supplied for an Elementary School.

I have endeavoured in these plates to compare the ordinary types of the more modern development of school planning in the two countries, the schools in all the cases selected being organised on the same principles, viz., that of separate class-room teaching. And while the English Schools are admirable examples of compact and ingenious planning, and fulfil all the requirements which sanitary science can demand in regard to ventilation and light for the pupils taught in them, they are most carefully arranged in every way to be as economical as possible, and every feature that cannot be proved to be actually essential for the educational or sanitary needs of the pupils is rigorously cut off. But although public opinion in this country will not tolerate an expenditure on the school which can in the smallest degree be considered unnecessary, it is equally determined now that our children shall be taught in buildings that are as hygienically good as they can be made. On the other hand, in Germany money is apparently much more easily forthcoming for school purposes, and the buildings seem planned with what appears to be an almost complete disregard for expenditure. Any feature or room that seems to offer a chance of advancing the efficiency of the school is at once included, regardless of the cost.

America.—The American Schools for elementary teaching comprise Grammar and Primary Schools. These are almost always in the same building, and correspond roughly to the Infant Department and older department of the Elementary Schools of this country, Massachusetts being the only State which supplies separate buildings for the Grammar and Primary Grades. No Master's office is found in the Primary Schools. The Head of the Grammar is also the Headmaster of the Primary Schools of his district. Primary Schools are always mixed, the Grammar usually so.

A class-room to hold 56 pupils* measures, as a rule, in the Primary Schools, 32 by 24 ft., and in the Grammar 32 by 28 ft., giving nearly 14 sq. ft. per head in the first case, and 16 sq. ft. in the second, considerably more than is considered necessary in England. Each class-

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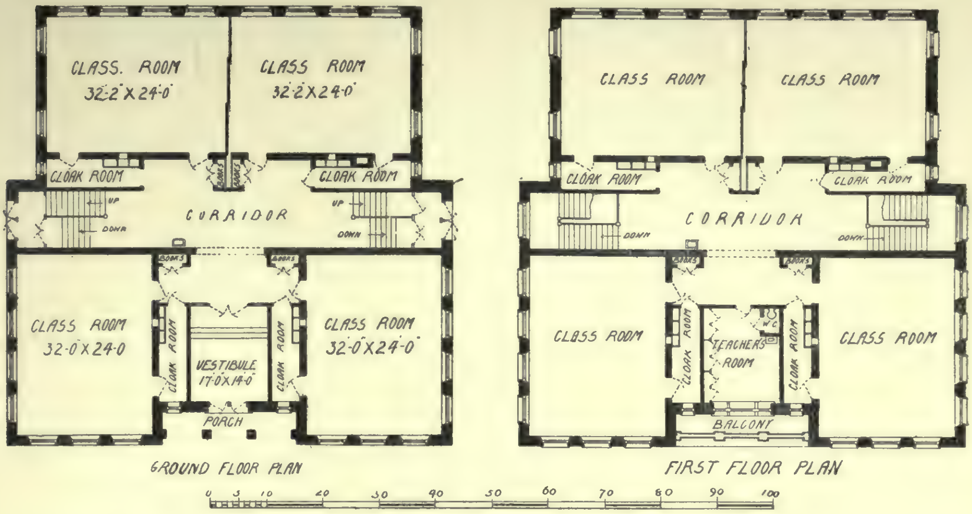
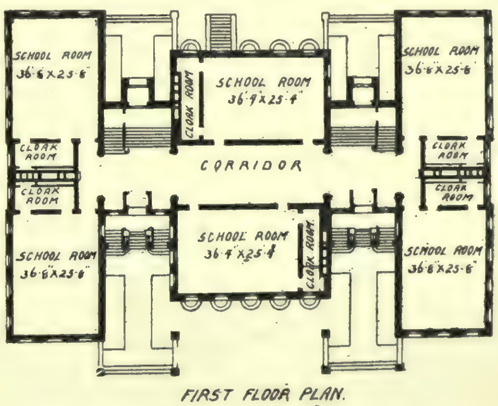
* American School Architecture, E. M. Wheelwright.

room has a separate cloak-room attached to it, with if possible an outside light, and one or both entrances to it from the class-room. Sometimes



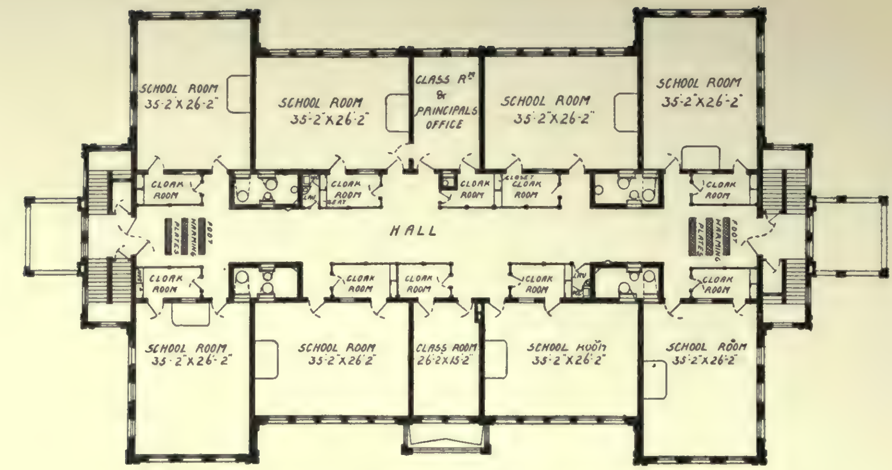
320, 321. Public School, Longshore Street, Philadelphia.

the hall is used for the purpose of a cloak-room by means of partitions.* A common method of planning in America is that of a square building with large class-rooms arranged at the corners, and so lighted on two sides, leaving the centre of the building for the hall and cloak-rooms (see Figs. 320, 321), American architects being seldom satisfied with one wall only from which to procure light. This is, however, usually rendered necessary by the great size of their school-rooms. See for example Fig. 322, showing he first floor plan of Auburndale School, Ohio, which consists of six rooms measuring over 36 ft. 8 in. by 25 ft. 8 in., and all of them arranged so as to obtain light on more than one side. This plan shows the cloak-rooms with entrance only from the class-room.

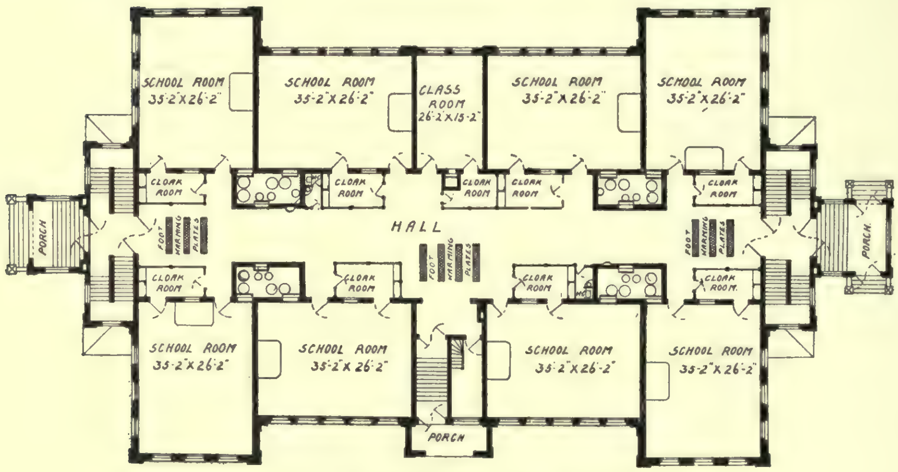


322. Auburndale School, Toledo, Ohio.

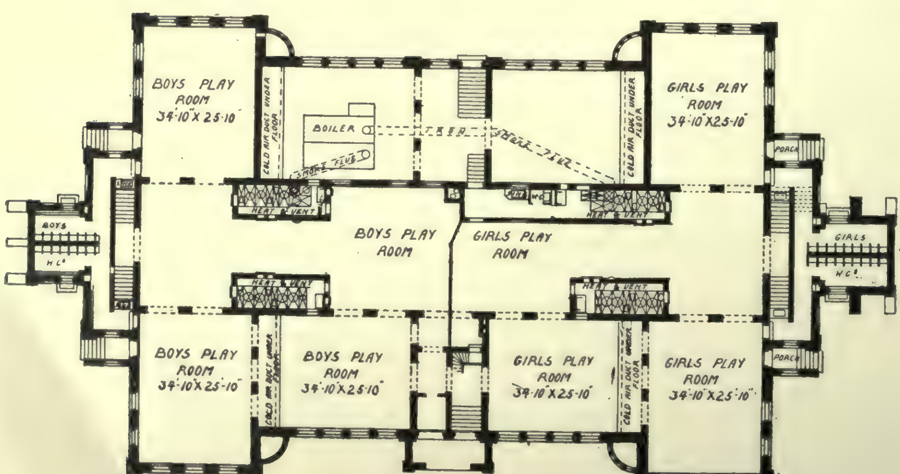
* See page 153, Cloak-room.



FIRST FLOOR PLAN



GROUND FLOOR PLAN



BASEMENT PLAN

323-325. THE FOWLER SCHOOL-HOUSE, CLEVELAND, OHIO.

Palliser & Palliser, Architects.

The toilet-rooms, W.C., &c., are not, in American Schools, located in a separate building, but are placed generally in the basement, where there is also, as a rule, a large playroom for both boys and girls. As an example of a large Elementary School there are given in Figs. 323-325 the plans of the Fowler School, Cleveland, Ohio.

The basement (Fig. 323) is entirely given up, as far as the pupils are concerned, to playrooms and lavatories. The large amount of space devoted to the heating and ventilation, which occupies the remainder of the space, should be noticed. The arrangements of the air ducts and smoke flues are indicated on the plans. The sanitary blocks are so placed that they do not, as is so often the case in American Schools, come actually under the main block of the building. The boys' half of the playrooms is divided from that of the girls' merely by an open-work railing called a "picket fence," each having their own staircase.

On the ground and first floor are placed the class-rooms. It will be noticed that most of the rooms are of large size, some 36 by 25 ft., and are called school-rooms, while three smaller rooms are provided marked class-rooms. It should be remembered that most of the actual oral teaching is done in these smaller rooms, more often known as "recitation" rooms.*

In the centre of the building is a wide corridor called the main hall, but the available space left after deducting the cloak-rooms, of which there is one to each school-room, is not large enough to answer the purposes for which a central hall is considered necessary in this country. Another feature that would probably be considered objectionable here are the closets placed in some of the cloak-rooms, and so in the centre of the building. They are of course placed against the large ventilating shafts, and are so probably quite safe, as long as the ventilation is working efficiently. The hall is lit by borrowed light from windows placed over the cloak-rooms. The foot-warming gratings should be noticed.

The building is spacious and conveniently planned. The school-rooms, though far too large† for our methods of work, are excellently lighted, while lavish provision has been made to ensure their efficient warming and ventilation.

Figs. 326, 327, show the floors of the Bridgeport School. The sanitary block is placed in this case outside the building.

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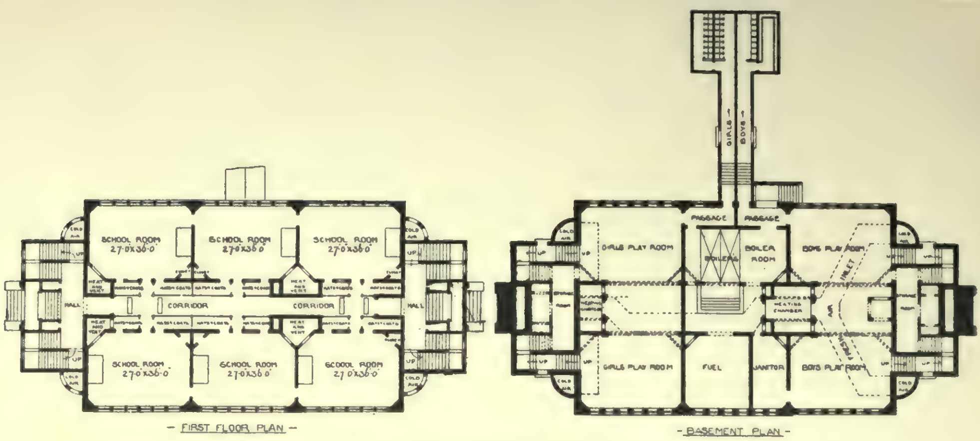
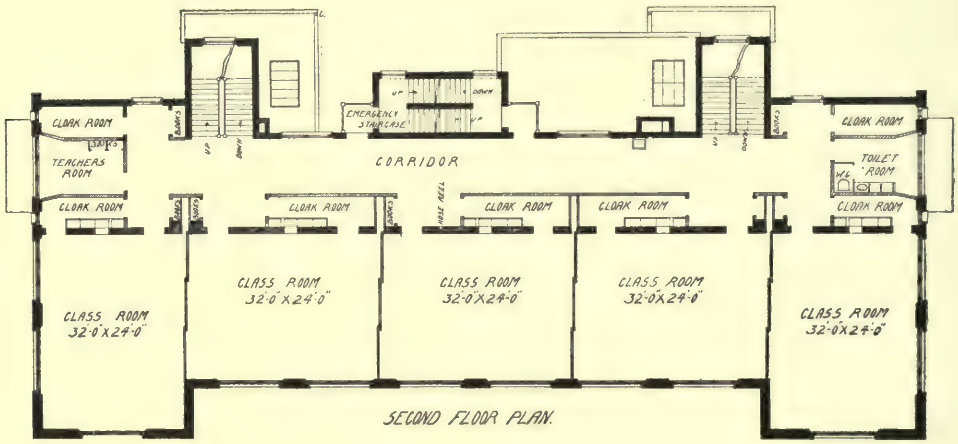
* See page 52.

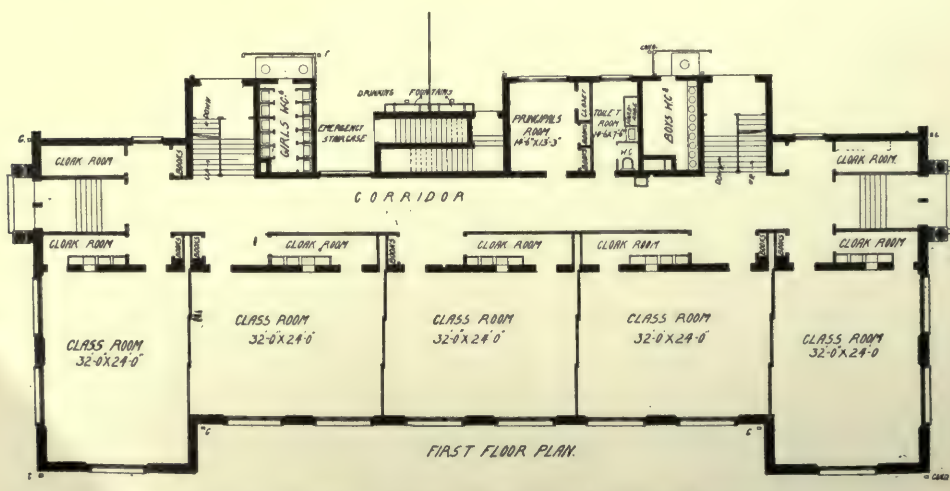
† The school-rooms would take 90 children on the basis of the Regulations of the Board of Education.



326, 327. THE BRIDGEPORT SCHOOL, U.S.A.

Warren Briggs, Architect.





328, 329. PUBLIC SCHOOL, PINE STREET, PHILADELPHIA.

Figs. 328, 329, show an American School arranged simply as a corridor, with the class-rooms opening off it. It will be noticed that the sliding partitions are so arranged that all the class-rooms on each floor can be at once thrown into one room running the entire length of the building. A hollow place is provided between the cloak-rooms into which the partitions can be run, so that the whole of the partition can be taken away. As there is no other division between the class-rooms except these movable partitions, it is difficult to see how disturbance caused by movement in an adjacent room is to be avoided. An emergency stair from the first floor is here provided.

It is hoped that the above short description and plans of German and American Schools will serve to illustrate some of the more important differences between Foreign Schools* and those of this country. It may, however, be worth while to draw special attention to some of them. As has been already pointed out, the use made of the hall is perhaps the strongest point of difference. The Continental School Hall being used for social functions, annual examinations, &c., shows generally some attempt at architectural treatment and decoration. In America the hall is often found in the centre of the building as in this country, but usually in the Elementary Schools partakes more of the nature of a corridor than in the English Schools, little objection being made to its use as a cloak-room by means of partitioned-off spaces, while in England every effort is made to keep the clear space as large as possible. In the more modern American Schools there is almost invariably found a separate cloak-room to each class-room as described above. This is not done in this country or in Germany, where till recently the walls of the class-rooms were considered sufficient. The sanitary conveniences, which in the Elementary Schools of this country are always placed in a separate building away from the main block, are in America always in the building itself, either in the basement or in an attached spur block. In Germany, till recent years, they were placed off the landings of the stairs, but the unsatisfactory nature of this arrangement has led in newer buildings to their being placed away from the school-rooms, generally against the gymnasium, but invariably connected with the main building by a covered way, the plan of making it necessary for the children to go out of doors whatever the weather being peculiar to this country. The floor space allowed in American Elementary Schools is

* There is a considerable similarity in the arrangement of the European Schools, so that it has been thought that to illustrate some German Schools would give a sufficient idea of the arrangement generally followed on the Continent.

very greatly in excess of both that provided in the class-rooms of this country and those on the Continent. To this is due the great size of the class-rooms in the American Schools, which combine the large numbers of an elementary class with a large allowance of floor space and single desks, which are usually only provided here for the relatively small classes of Secondary Schools.

A further noticeable point in American Schools is the large provision of ventilating ducts, and arrangements for the provision of fresh air and warming. Some of these systems have been adopted in this country, but not often on so lavish a scale, nor is there anything like the same provision for this made as is the usual custom in the United States. The more rigorous climate of that country, and the much greater range of temperature to be provided for, no doubt accounts for this to a large extent. The school gardens and decorative treatment of the playground, which form features of Continental Schools in Northern Europe, are found neither in England nor America.

For further examples of large Elementary Schools subsequent to 1880, see—

Note.—Large sized figures refer to volumes, smaller to pages.

The Builder.—39, 44; 41, 266, 335, 388, 450, 512; 42, 70, 130; 44, 412; 45, 146; 46, 247, 572; 49, 54; 50, 506, 845, 849; 51, 124; 52, 282; 53, 615; 54, 27; 55, 396, 452, 470; 56, 298; 57, 174; 59, 386, 407; 61, 87; 62, 324; 66, 100; 70, 449; 72, 80; 73, 279; 74, 178, 317; 76, 28, 176, 316, 499.

The Building News.—39, 210, 270, 470; 44, 98, 190; 45, 208, 368, 528; 48, 89; 51, 344, 568; 53, 54, 320, 860; 54, 180, 458; 56, 66, 720; 57, 817; 58, 202, 203; 61, 286, 644; 62, 365, 499; 63, 805; 64, 334; 65, 507; 66, 75, 797; 67, 857, 891; 68, 335, 476, 617; 69, 701, 557; 70, 43, 168, 301, 489, 745; 73, 761, 905; 75, 139, 515, 563; 76, 807; 78, 295, 353; 79, 413; 80, 333; 81, 691, 836, 691.

The British Architect.—16, 602; 40, 255; 46, 361, 364, 382; 52, 328; 54, 480.

For further examples of Higher Grade Schools, see—

The Builder.—49, 356, 697; 70, 213; 73, 497; 74, 322; 80, 609.

The Building News.—51, 686; 60, 804; 62, 90, 399; 63, 561; 64, 503; 71, 75, 147; 74, 707; 77, 477, 547; 78, 423.

Chapter XX.

ELEMENTARY SCHOOLS

(*Continued*).

HIGHER GRADE ELEMENTARY SCHOOLS.

Origin of the Higher Grade Schools—Differences in the Buildings from the Elementary Schools—Laboratories—The London Higher Grade Schools—The Central Higher Grade School, Manchester—Higher Grade Schools at Scarborough, Nottingham, and Falkirk.

As soon as the attendance at the Elementary Schools became somewhat more regular, it was found that in some schools there were a number of pupils whom it was possible to take beyond the seventh or highest standard as recognised by the "Code" of the Board of Education; although many schools still found that six standards were all they could manage. The raising of the leaving age, and the abolition of half-time, with further restrictions and more stringent regulations against exemption, naturally tended to increase the numbers of the pupils in the higher standards. As a rule, however, except in the case of very large schools, there were not a sufficient number of these advanced scholars to form a class, and they were generally taught by the master taking Standard VII. at the same time, while teachers in small schools, or in those neighbourhoods where the parents took away their children at the earliest opportunity, probably had to take Standards V., VI., and VII. together. The London School Board in 1887 made an attempt to meet this difficulty by appointing one school in each group, which was to have a special class, and to which any children sufficiently advanced should come from the other schools in the group. In these schools some arrangements were made for the better teaching of science, by the provision of laboratories, &c.

This was open to many objections. The other schools naturally did not like sending on and so losing all their most promising pupils; the

selected schools became overcrowded in the lower forms owing to parents sending their children there in preference to other schools, in order to make sure of their admission to these high forms. It was in order to provide for this class that the special schools known as Higher Grade Schools were erected. These are now recognised by a Minute of the Board of Education, which provides that they shall be separate schools, with a four years' course beginning with Standard IV. No pupil is admitted to these schools without having attended for at least two years at a Public Elementary School, and having a certificate from a Government inspector that he or she is capable of profiting by the instruction in the Higher Grade School.*

The buildings for Higher Grade Schools differ from the ordinary Elementary Schools chiefly in the smaller size of the class-rooms, and in the provision of rooms for special instruction, such as laboratories, rooms for drawing, manual instruction, needlework, domestic economy, &c. The number of scholars attending one Higher Elementary School is limited by the "Code" to 300, for which number ten class-rooms would be required, and of which four at least should be capable of accommodating 40 scholars.

The regulations further require that not less than 15 sq. ft. of floor space should be provided for each scholar in the class-room, which is to be furnished with single desks, the gangways to be 2 ft. wide, the laboratory accommodation to be as follows:—The laboratory must be sufficiently large to provide at one time for the largest class in the school. A separate laboratory should generally be provided for chemistry and for physics. A laboratory should afford 30 sq. ft. of floor space for each scholar, the minimum size to be 600 sq. ft., but if possible it should be somewhat larger. When the laboratory accommodates more than 25 pupils, a second teacher is required. Laboratories must be fitted with suitable tables, which must be well lighted. They should be properly supplied with gas and water. For chemical laboratories, sinks, cupboards, and the necessary fume closets must be provided. A small balance-room should be added if required.

In addition to the class-rooms and laboratories it is desirable that a Higher Elementary School should include at least one lecture room, which should be fitted with a lecturer's demonstration table and properly arranged seats.†

The plans of the Higher Grade Schools vary from a building little

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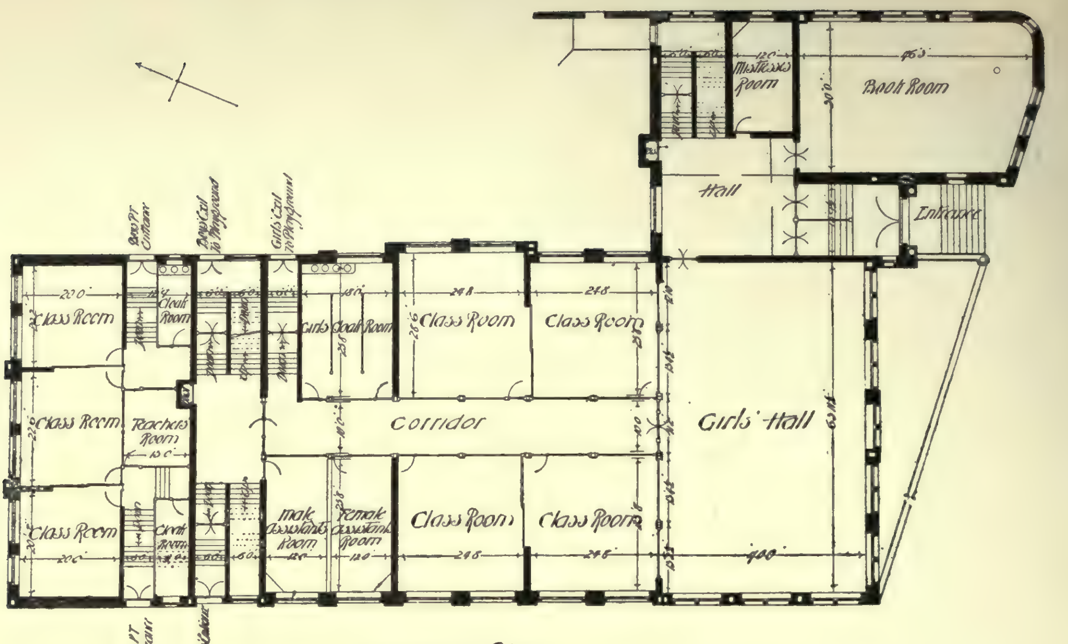
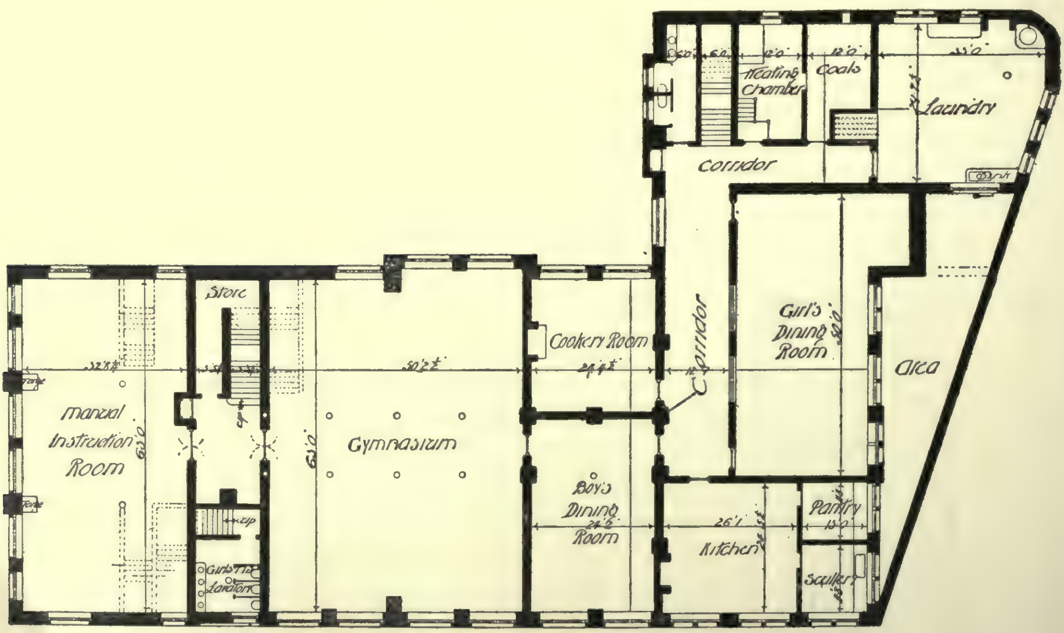
* For a further account of these schools see Introduction, page 8.

† For science rooms see *ante*, Chapter VIII.



Ground Plan

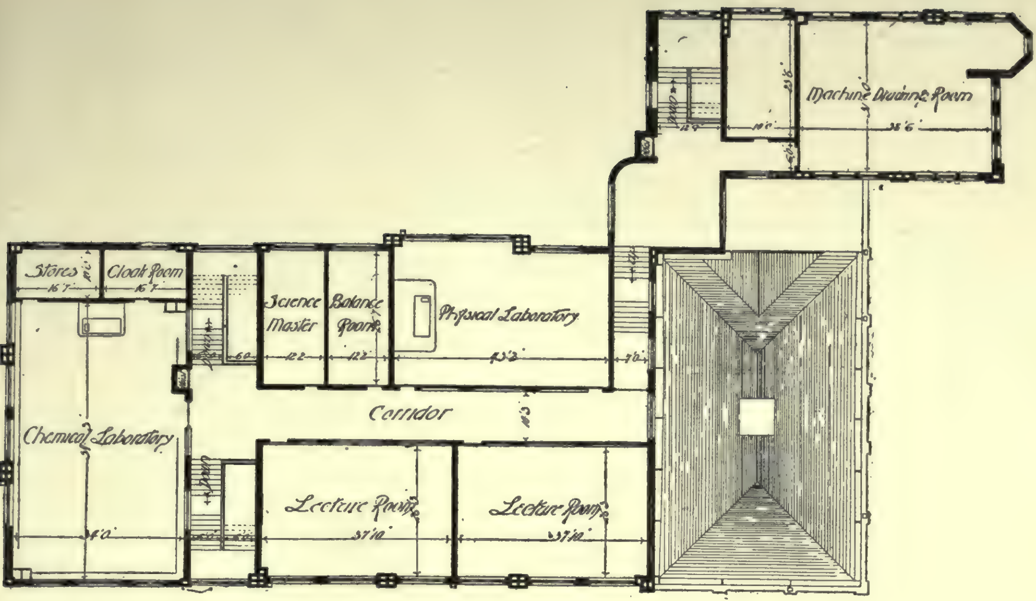


Basement Plan

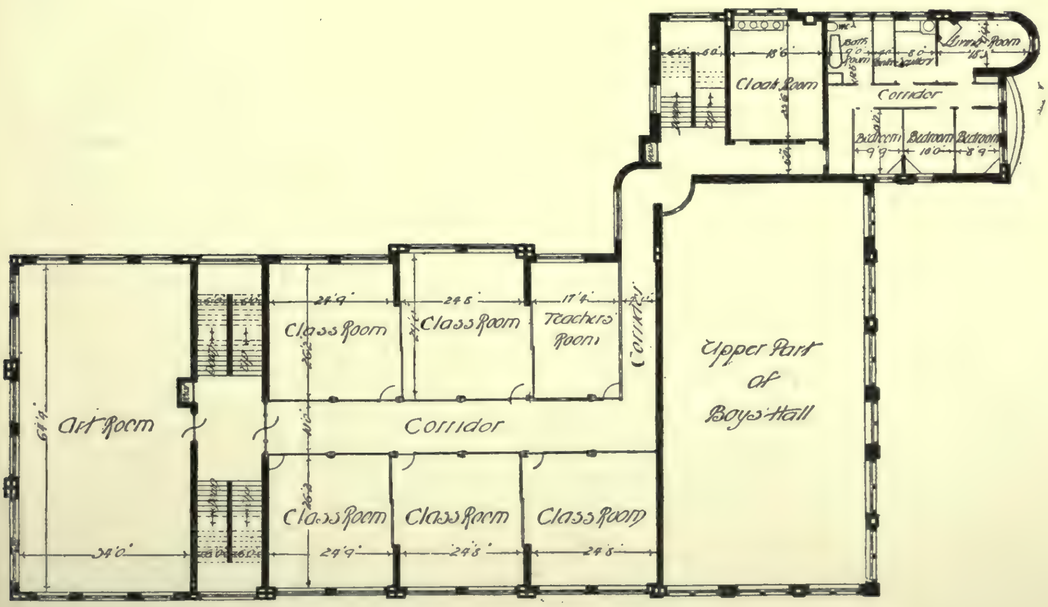
Scale 10 5 0 10 20 30 40 50 60 70 80 90 100 of Feet

332-335. THE CENTRAL HIGHER

The Manchester School Board.



Third Floor Plan



Second Floor Plan

Scale 10 5 0 10 20 30 40 50 60 70 80 90 100 of Feet

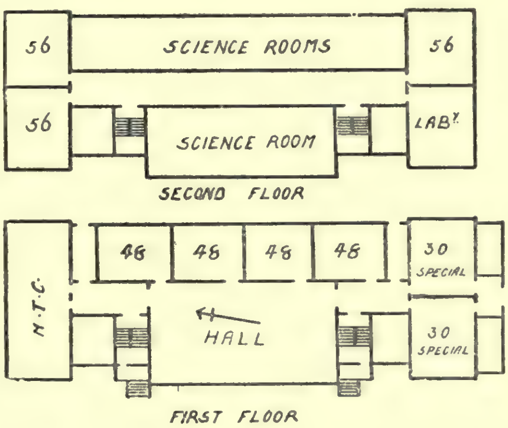
DE SCHOOL, MANCHESTER.

Potts, Son, & Hennings, Architects.

Between pp. 356 *and* 357.

different from an Elementary School, but having the top floor devoted to science teaching, to buildings so elaborate that they ought more properly to be called Technical Schools. The diagrams in Figs. 330 and 331 show the adaptation of the ordinary type of London Board School to the purposes of a Higher Grade School. This, it will be noticed, is very similar in general arrangement to that of the Cobbold Road Elementary School (see Figs. 278, 279), the top floor being devoted to science teaching, drawing, needlework, clay modelling, &c.

The Central Higher Grade School, Manchester.—In Figs. 332-335 are shown the plans of a large and important school of this type recently erected in Manchester. There is accommodation in this building for 1,450 pupils. Of this number reserve class-room is provided for 250. There are 700 pupils in the elementary grades, and 500 in the upper standards, or as it is called, the School of Science. In 1900 there were, of 1,048 scholars on the books, 421 in the advanced section (298 boys and 123 girls), and 627 in the elementary section. All the pupils entering are required to have passed the Fourth Standard of an Elementary School or an equivalent examination, and pay a fee of 6d. a week in the Elementary School, and the same in the advanced classes if the child of a ratepayer, otherwise the charge is 1s. The fees are, however, remitted when it seems necessary or desirable. In the basement of the building, besides the gymnasium, manual training room, and cookery instruction room, there is a dining-room where scholars are allowed to dine, and may have the food they bring with them warmed, and be supplied with tea or coffee at a small charge. This is found very necessary, as many of the pupils come considerable distances, some arriving by train. There is a library 44 by 31 ft. on the ground floor, and a separate assembly hall 80 by 40 ft. for boys and girls. The class-rooms have in most cases movable partitions, and are arranged to accommodate classes of different numbers. The studio is a large room 64 by 34 ft., arranged with desks for model and freehand drawing. The chemical laboratory on the third floor has benches



330, 331. DIAGRAM SHOWING A HIGHER GRADE SCHOOL.

for 40 pupils, as has also the physical laboratory. There are small additional chemical and physical laboratories for students doing advanced work.

The next example (Figs. 336-339) shows a *Higher Grade School at Scarborough.* This is a considerably more elaborate building, a larger amount of space being devoted to rooms for technical teaching in proportion to the class-room accommodation.

The basement is 14 ft. high in the clear, and one of its features is a gymnasium 20 ft. high, reached from both playgrounds by means of boys' and girls' open porch and a separate staircase. There is also a complete laundry, consisting of ironing and washing rooms, with dryers, for the instruction of 40 girls in two classes. Immediately adjoining this is the cookery kitchen, with scullery and pantries abutting on the girls' main staircase. There is accommodation in the cooking kitchen for 36 girls, and it is fitted with gas stoves and open fireplaces, and all necessary shelving, tables, cooking utensils, and requisites for the instruction classes.

Towards the east side are two dining-rooms for 12 children each, accessible from the respective playgrounds. Adjoining the boys' dining-room is a spare class-room, and immediately adjoining this is a joiner's shop, with accommodation for 40 boys. There are also unpacking rooms, store-room, cloak-room, and lavatory for each department using this floor. A caretaker's room, a boiler-house, heating chamber, &c., are also provided for.

The ground floor is 15 ft. 9 in. in the clear, and is fireproof. The boys' and girls' main entrances are connected with the new approach road by bridges spanning the areas. Two cloak-rooms adjoin the main entrance, each having 300 pegs and lavatory basins. There are on this floor four class-rooms with accommodation for 40, there are four with accommodation for 50, and four with accommodation for 60, making a total of twelve class-rooms with accommodation for a total of 600 children. Each class-room is provided with book cupboards, with sliding doors, arranged in recesses in internal walls. Out of the twelve class-rooms provided, ten face the south.

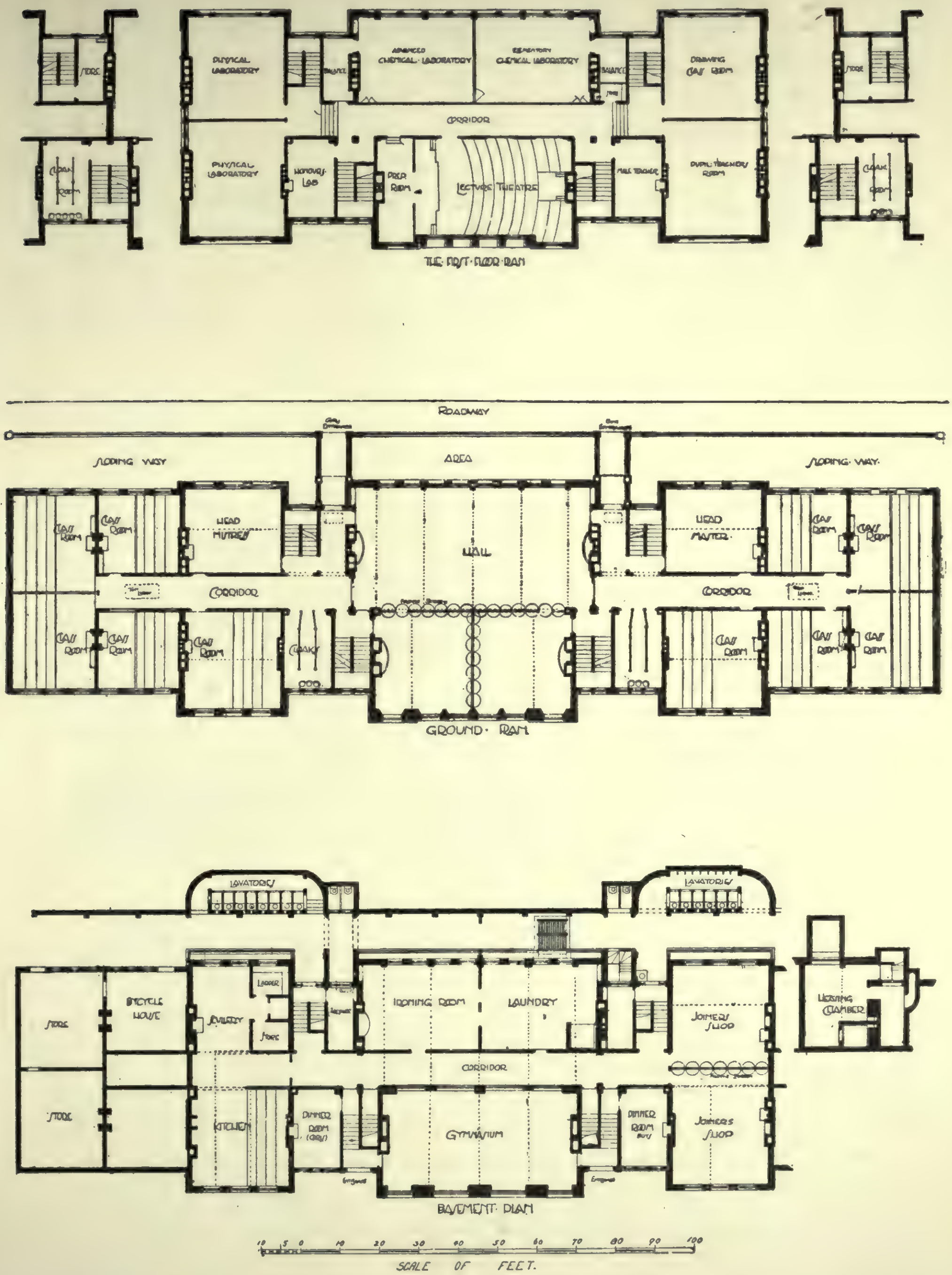
The central hall covers a superficial area of about 3,600 ft. On one side is to be found the Headmaster's room, anteroom, packing store, with lift communicating, and on the other side the school lavatory.

On the upper floor there are two rooms for assistant teachers—one for each sex—placed over the cloak-rooms, and reaching from the second half-pace of the main stairs. There is also a class-room for pupil teachers' instruction, containing 480 superficial feet. A chemical

336. Higher Grade School, Scarborough.

Hall, Cooper, & Davis, Architects.

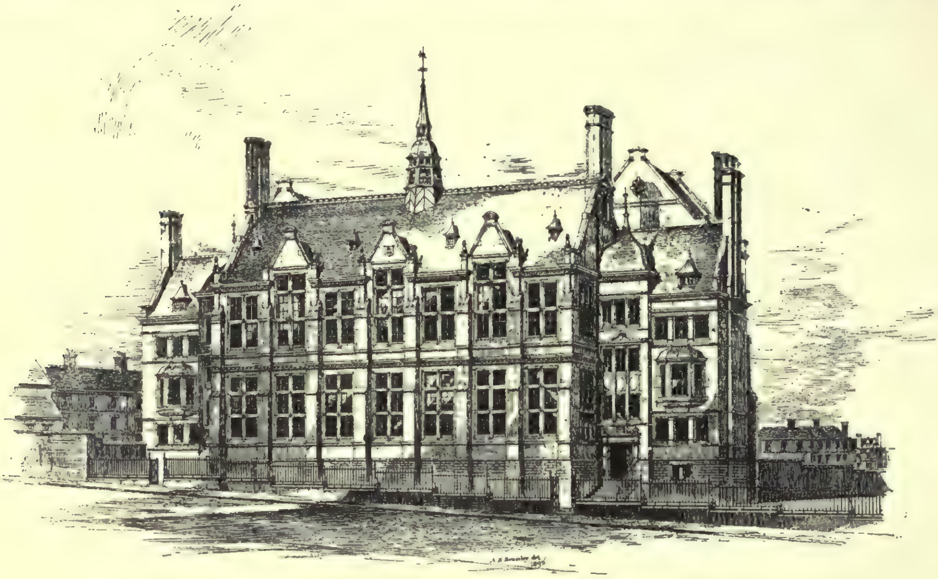
To face p. 359.



337-339. Higher Grade School, Scarborough.

The Scarborough School Board. *Hall, Cooper, & Davis, Architects.*

laboratory is provided, with fifty benches divided by glazed partitions into sections, and a room for honours work, the whole being fitted up to the regulations of the Science and Art Department with fume cupboards, blackboards, and stores for reagents, &c. There is a small balance-room overlooked from the chemical laboratory properly fitted up with glass cases, working table, and draught closet. A physical laboratory for 32 students is provided, and is divided into two sections by a screen. There is a lecture room to accommodate 100 students, provided with demonstration table and platform, and lantern platform, with shutters to the windows for darkening the room during the lantern lectures. A preparation room is connected with the lecture theatre.



340. THE STANLEY ROAD HIGHER GRADE SCHOOL, NOTTINGHAM.

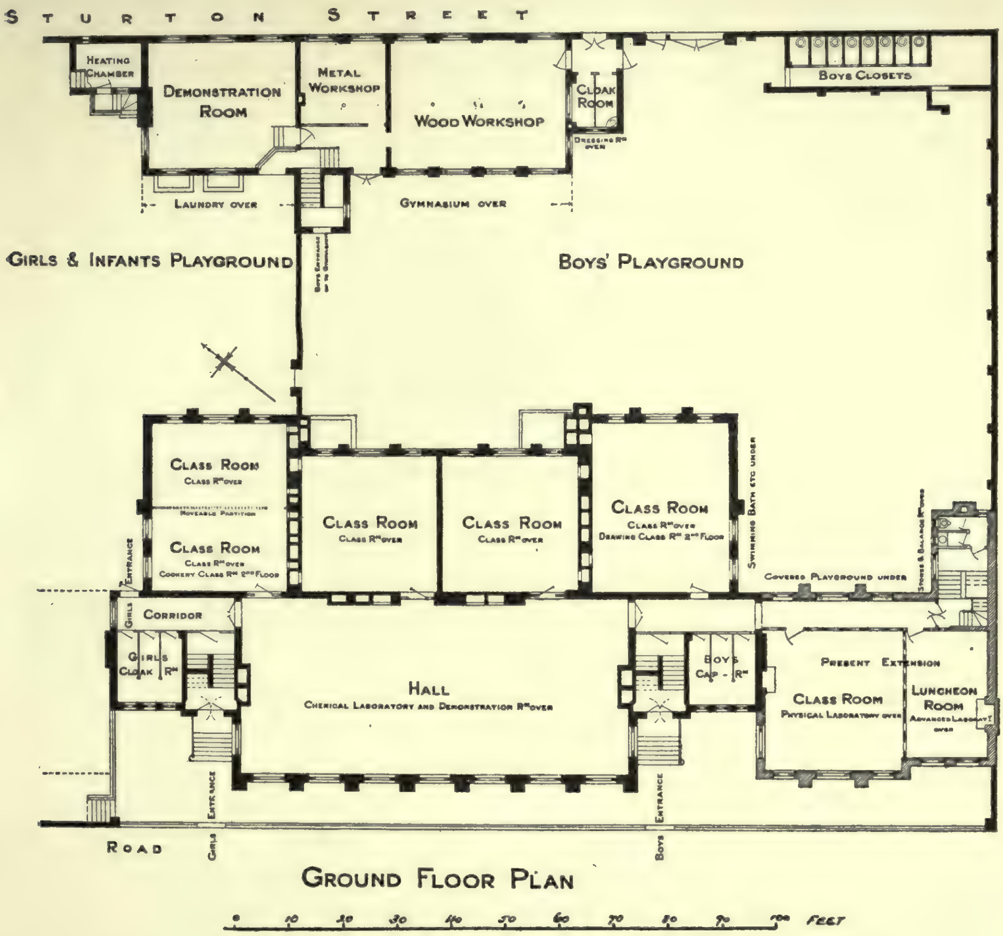
A. N. Bromley, Architect.

There is a drawing class-room with top and north studio light to accommodate 60 elementary students, and a small class-room for the same purpose for advanced students. These rooms are placed near the boys' staircase, but are accessible from the other staircases. Besides a spare class-room, with accommodation for 60, a book store, with lift and caretaker's cupboard, are provided.

The latrines are separated from the school and placed under the roadway adjoining the area.

The whole building is warmed by open fires and steam radiators at low pressure. The school is ventilated by a system of natural ventilation with extra shafts from each room, with inlets at the ceiling and

floor levels, and carried into the roof ventilator. There are fresh-air inlets at the window levels direct from the outside, passing through steam radiators, the rooms on the top floors having extractors in the ceilings. The building is lighted by sash windows, all of which are made to open.



341. THE STANLEY ROAD HIGHER GRADE SCHOOL, NOTTINGHAM.

A. N. Bromley, Architect.

Stanley Road Higher Grade School, Nottingham (Figs. 340, 341).—This school is well situated upon an open piece of ground. The class-rooms open off the large assembly hall, which measures 70 by 32 ft., and have sloped floors instead of steps to raise the back rows. On the first floor in addition to the class-rooms is a chemical laboratory, 40 by 27 ft., providing bench room for 56 pupils, and a lecture theatre. On the

third floor is placed the cookery class-room with its scullery, stoves, &c., and the studio. The accommodation for teachers is provided in a mezzanine floor. Separate dining-rooms for boys and girls are provided for those pupils who come from a distance. There is a swimming bath arranged in the basement; while a separate block of buildings provide a gymnasium, physical laboratory, and laundry. A noticeable feature is a garden in the playground measuring some 88 ft. in length and 10 ft. in width, in order to illustrate lessons in botany, physiography, &c. The ventilation is arranged on the Plenum system. The incoming air is

342. THE FALKIRK HIGH SCHOOL.

A. & W. Black, Architects.

drawn through a cleaning screen, being then warmed and then driven into the rooms by a fan worked by a gas-engine.

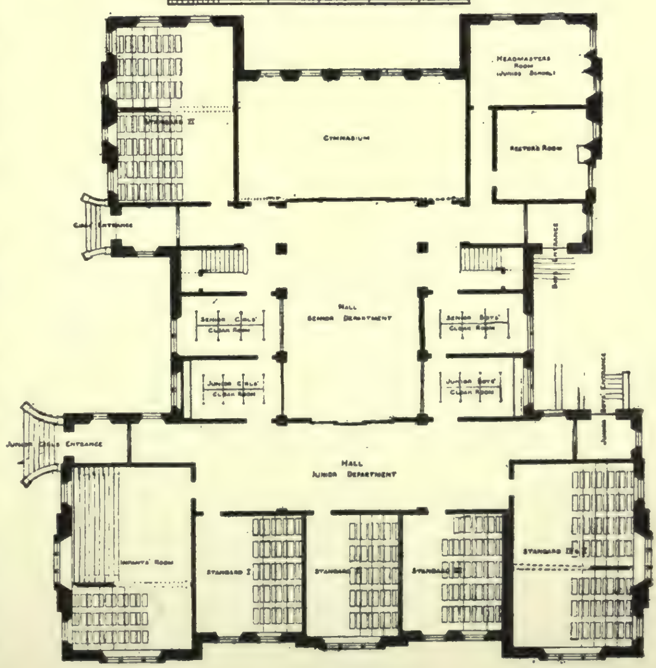
The Falkirk High School.—Figs. 342-344 show the arrangements of a Scotch School combining an Elementary and Higher School in one building, the first four standards forming the junior department. The ground floor of the school is occupied by the junior department. The class-rooms, six in number, can be converted into nine by glass sliding partitions. In addition there is cloak-room and lavatory accommodation, besides a private room for the Headmaster. On this floor there is also situated the gymnasium, as well as the rector's business room. The school is planned on the central hall system. By means of sliding partitions, the central hall, junior department hall,

and gymnasium, can be thrown into one apartment when occasion arises. On the upper floor of the school are situated the class-rooms of the senior department, and chemical and physical laboratories, with large lecture-room. Space has been found for art and music rooms by raising the building to three storeys in height at both back and front. The class-rooms are heated by low-pressure hot-water pipes. The accommodation of the school is:—Junior department, 426; senior department, 515—total, 941. It will be noticed that in some cases the class-rooms are lighted by windows placed at the back of the room.

Evening Continuation Schools. — The schools hardly concern us here, as all questions arising in connection with them are educational, the buildings being the ordinary Elementary Schools. As mentioned above, some provision in the way of desks might be made to meet the needs of the pupils attending these schools, of whom a considerable number are adults.

Upper Floor Plan

10 5 0 10 20 30 40 50 FEET



Ground Floor Plan

10 5 0 10 20 30 40 50 FEET

343, 344. THE FALKIRK HIGH SCHOOL.

Chapter XXI.

ELEMENTARY SCHOOLS

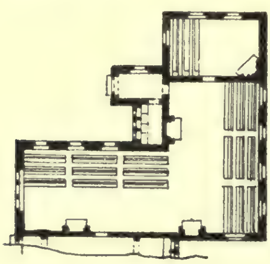
(Continued).

VILLAGE AND POOR LAW SCHOOLS, AND BUILDINGS FOR SPECIAL CLASSES.

Small Country or Village Schools, Description of—Use as Parish Room—The Cressing Schools—Mixed and Separate Schools—Examples of School—The Oakbank School—**Schools for Mentally Defective**, Deaf, and Blind Children—Methods of providing for such Children—Epileptic Children—Example of "Special" School—Crippled Children—Furniture for Cripple School—Boarding Schools for Deaf and Blind—**Poor Law Schools**, Description of—Boarding-Out *versus* Large Schools —"Barrack School" and "Cottage Home" School—Sites, Area required—Grounds —Dormitories—The Chase Farm Schools, Plans and Description—The Hornchurch Cottage Homes, Plans and Description.

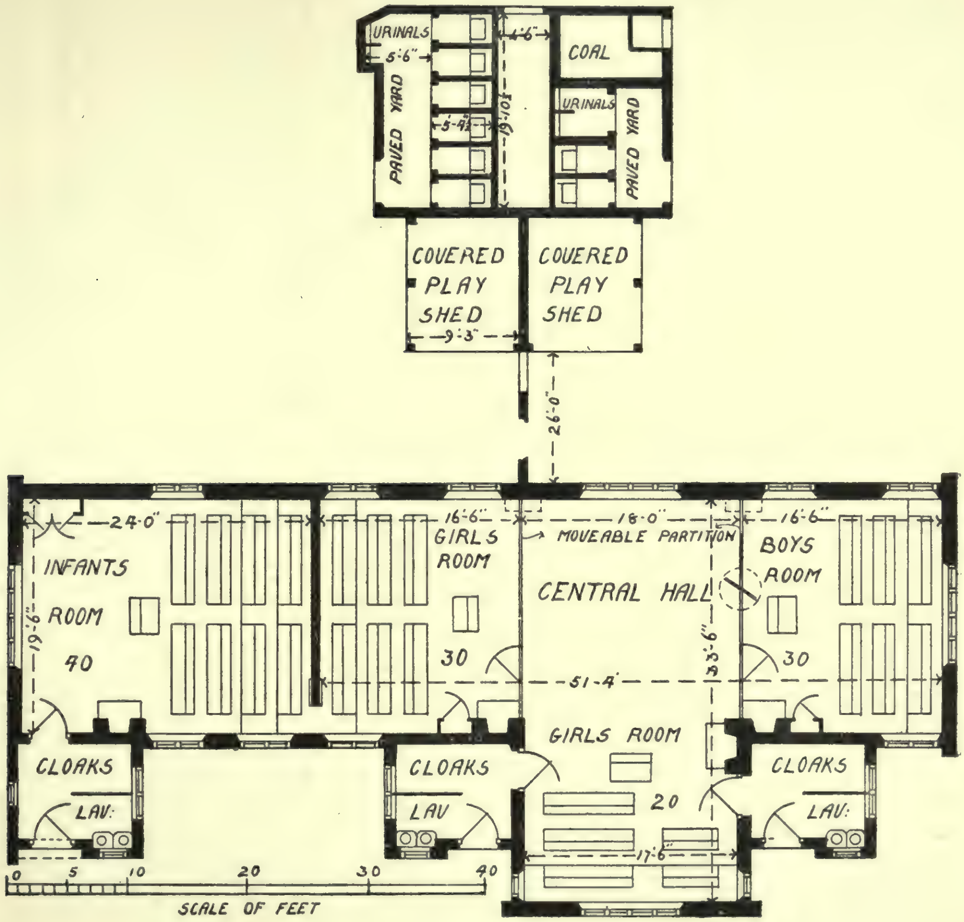
COUNTRY SCHOOLS.

The arrangement of small country schools depends to so large an extent upon the individual requirements of the place and site that it is very hard to lay down any particular type as generally applicable. In most cases they are Voluntary Schools, and having no rates to fall back upon, there is often considerable difficulty in raising the necessary funds. The plan is, under these circumstances, more likely to be regarded from the point of view of what is the minimum in the way of accommodation and building that can be squeezed through the Education Department, rather than what is desirable from the point of view of the school. Owing again to the difficulty of expense, the teaching of the school is usually carried on to a great extent by the employment of pupil teachers, so that the type of building has to be arranged for this purpose—that is to say, with the long narrow class-rooms (see Fig. 345)



345.
School Arranged on the Pupil Teacher System.

in which a number of classes can be taught under the supervision of the head teacher. In planning a country or village school it should be borne in mind that the building will probably have to serve for the purpose of entertainments, meetings, &c. The use of sliding partitions will often make this feasible, without unduly interfering with the legitimate



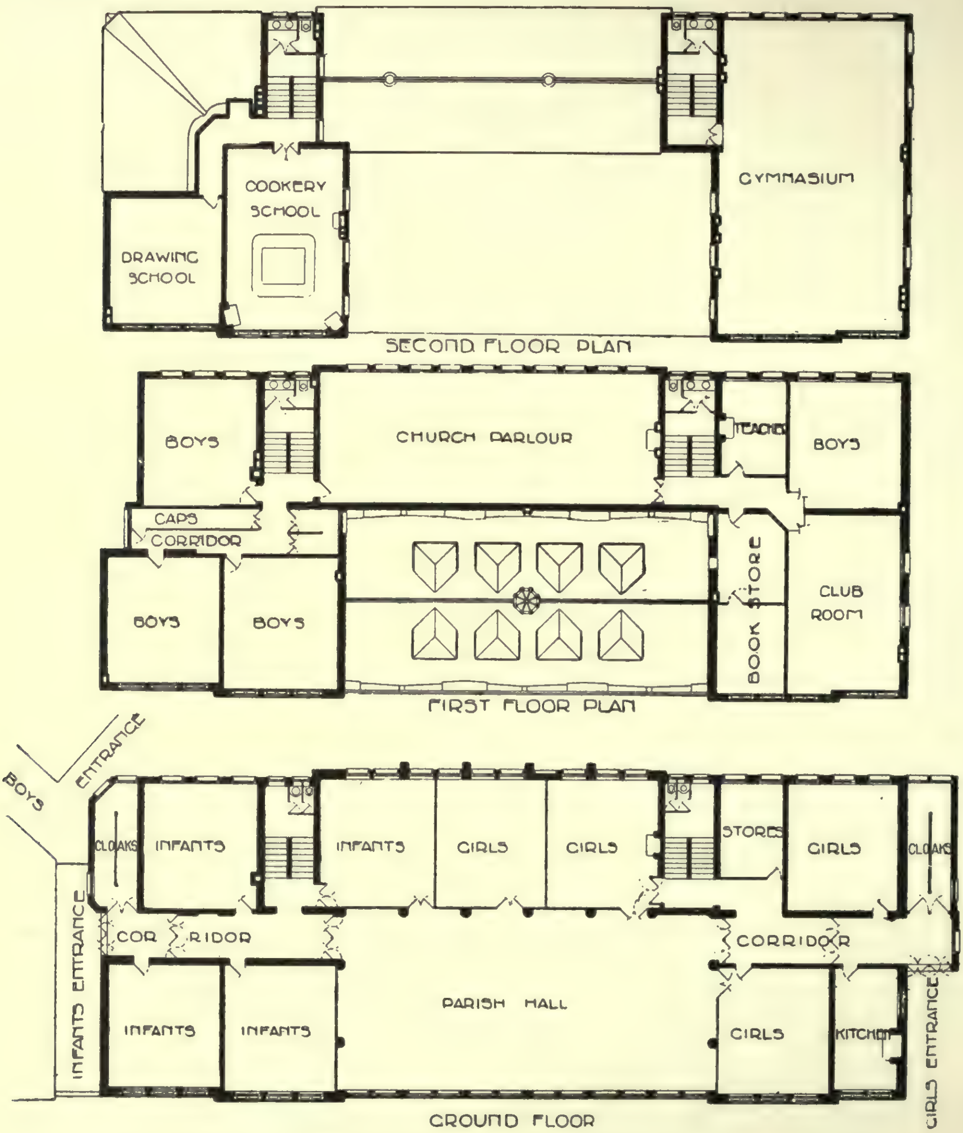
346. THE CRESSING SCHOOLS, CHELMSFORD.

Clare & Ross, Architects.

object of the building (see Fig. 346), and which gives the plan of the *Cressing Schools* for the Chelmsford School Board. This shows a useful form for a village school. By means of movable partitions it is possible to get a clear space 51 ft. long. At each of the separate entrances for boys, girls, and infants is placed a small cloak-room and

lavatory. The school has accommodation for 120 children, and cost about £2,000.

Figs. 347-349 show combined school and parish buildings on a

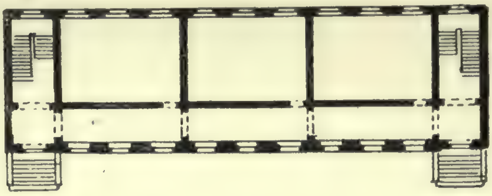


347-349. Parochial Buildings, St James-the-Less, Bethnal Green.

E. Hoole, Architect.

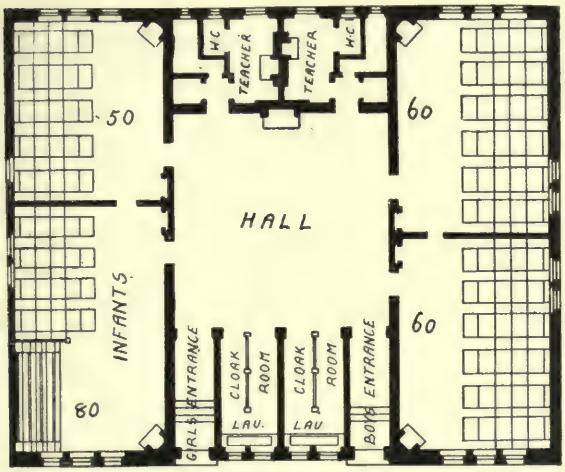
considerably larger scale. In this case the hall is placed in the best position for school purposes, but so arranged as to be easily available for parish purposes.

In Germany the school keeps its usual arrangement of class-rooms opening off a corridor, even when the school is quite small. See for example Fig. 350.



350. A Small German School.

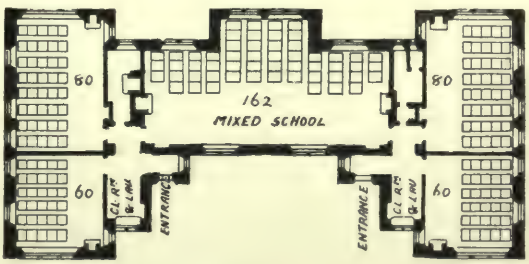
Village schools are not infrequently arranged with separate buildings for the different departments, the boys being placed in one, the girls and infants in the other, a separate building being sometimes provided for the Infant School as well. When the numbers in the school are small, it results in greater efficiency and economy to have the schools "mixed." A residence for the master is usually provided in the school grounds.



351. The Oakbank School, Scotland.
J. Graham Fairley, Architect.

In its smallest and simplest form the school consists of one room, with a porch which serves for cloakroom and lavatory. With rather larger numbers the main school-room tends to become longer, and has a class-room at one or both ends. Where the sexes are taught together there must be separate entrances for the boys and girls leading to their playgrounds.

In Fig. 351 is shown an example of a simply planned Scotch country school with a central hall to take 250 children. The infants' room is provided with a gallery. Each of the class-rooms is arranged to take two standards.



352. Girls' and Infant School, Armadale.
J. Graham Fairley, Architect.

Another small school for girls and infants is shown in Fig. 352, also from Scotland.

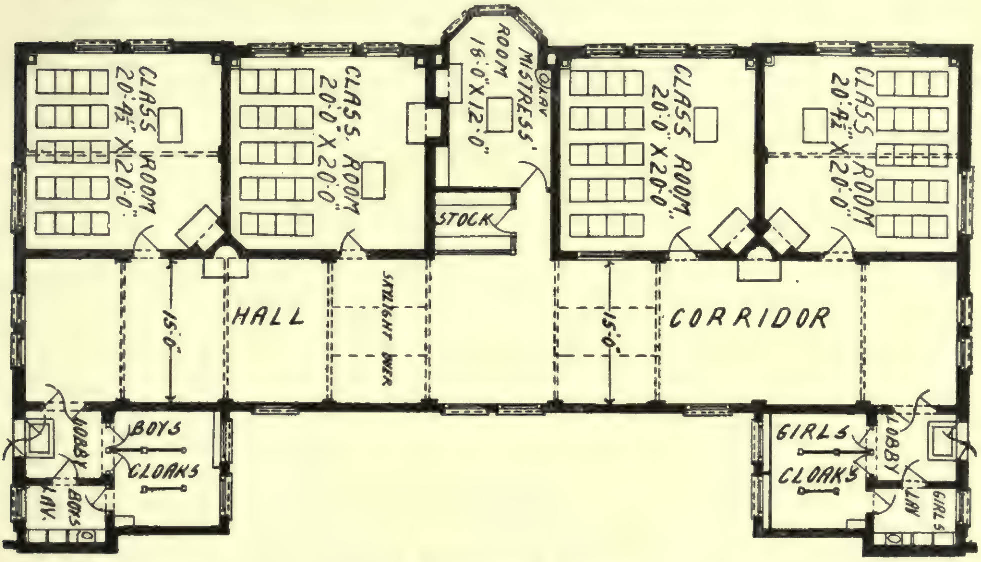
SCHOOLS FOR "SPECIAL" CHILDREN.

Schools for the Mentally Defective, Deaf, and Blind.—There are a certain number of children who, not being sufficiently imbecile to be sent to a lunatic asylum, are yet too deficient in mental power to profit by the instruction given in the ordinary Elementary Schools. For these children special classes are formed in the ordinary schools, or where there are a sufficient number, special schools, arranged expressly with a view to provide for their more efficient teaching. A certain number have so far profited by their work in these schools that they have been able to return to the ordinary Elementary Schools. Power is given to School Boards to deal with this class of children under the Defective and Epileptic Children's Act of August 1899. This Act directs school authorities to take steps to ascertain what children in their schools are so far mentally wanting, not being idiots or imbeciles, as to be incapable of being taught by the ordinary Elementary School system, and to make such provision for their instruction as may be suitable. The Act gives them power to force any parents they deem necessary to allow such children to be medically examined, and at the same time makes it obligatory on the school authorities to have examined any child whose parents so wish it, in order that the child may be sent to a "special" school.

School authorities have three methods of dealing with such children, either by instituting special classes for them in ordinary Elementary Schools; by boarding out the children in some house near to an existing "special" class or school; or by establishing themselves "Special Defective Schools." In the second method they may contribute towards the expenses of the children placed in or near a "special school" belonging to another Board. They are further empowered to provide guides or conveyances for children who would otherwise be physically unable to attend school. These arrangements are to be made also for epileptic children. The parents of such children are liable for contributions towards expenses of guides, conveyances, meals, &c., but of course not towards the education. In the case of defective, epileptic, blind, or deaf children, the age of compulsory attendance at school is lengthened to sixteen years.

Buildings for Defective Children.—The regulations as to the buildings for this class of children are given in the Appendix. Very much larger floor space is required for these children than in the case

of the ordinary Elementary Schools, 20 sq. ft. being required for each child in average attendance. In the class-rooms for teaching deaf children it is of the utmost importance that the lighting should be very strong. A top light is often a great assistance in enabling both the children and the teacher to watch the movements of the throat and lips, upon which so much of the teaching depends. Fig. 353 shows one of these schools as constructed by the London School Board. The class-rooms are all on the ground floor, and have open fireplaces. The hall takes the form of a wide, well-lighted corridor, for the purpose of drill and assembling. It is usual in schools for mentally defective children to supply arrangements for washing children, much on the lines of the



353. A "Special" School.

The London School Board. *T. J. Bailey, Architect.*

arrangements described in the account of the German Schools—that is to say, spray baths, two to each department being usually found sufficient. The school illustrated will take 80 children.

Schools for Crippled Children.—During the last few years the London School Board has been making considerable efforts to provide for children who, though not mentally deficient, are crippled to such a degree as to prevent their attendance at the ordinary schools. For this purpose there is provided an ambulance which goes round with a nurse in attendance and takes the children to and from school. In one or two cases schools for the mentally defective have been altered for the purposes of cripple children. These buildings answer the purpose

well, except there is no provision for cooking arrangements. Since the children in the Cripple School cannot return home in the middle of the day for their dinner, it becomes necessary to provide meals.* In the buildings that have been converted, the room for the spray baths not being required, has been turned into a kitchen, but this is of hardly an adequate size in which to cook for some 30 or 40 children. The hall or corridor serves well enough for the dining-room by the use of movable trestle tables. A plan as shown above, with the addition of a kitchen and scullery, would serve excellently for a Cripple School, though it would be an unfortunate neighbourhood that could provide sufficient crippled children to fill a school of 80. Two class-rooms would usually meet the wants of most districts, and by means of separate entrances, dividing the building, &c., it could well be confined with a mentally defective centre.

Provision should be made so that the ambulance can drive right up to the door of the school, to enable the children who are incapable of walking to be easily carried in.

The main difference between a school for cripples and other schools lies in the desks and chairs. A fair proportion of the children will be found able to use the ordinary form of desk, so that a considerable number of these will have to be provided. For the others, a few couches for those who are unable to sit up, and arm-chairs supplied with foot rests. The chairs as used at present are not entirely satisfactory. The desks which are arranged to fit on the arms are too low and too near for comfortable work, while the foot rests being made so that they can be folded back under the chair, are too short for any but the smaller children. The system of small, light, movable tables that can be placed across the chair appear much more satisfactory. These schools, which are in their experimental stage as yet, do appear to supply a means of teaching a certain number of children who are not in any way deficient mentally, but who by their physical disabilities are prevented from attending school.

The regulations for Boarding Schools for children who are deaf and blind are given in the Appendix. It is considered advisable that the numbers should be carefully limited, and that while something on the Cottage Home principle would probably offer the best solution of their arrangement, no cottage should take more than ten children, and those all of one sex.

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* These meals are managed by the nurse in charge. The parents are expected to pay for their children's dinner, and the nurse collects the money on her morning round to pick up the children.

POOR LAW SCHOOLS.

Poor Law or District Schools are establishments for the reception of the children of paupers, or in some cases those of widows left with more children than they can be reasonably expected to provide for. In the case of children with able-bodied parents living, the parents must be in the Workhouse. These schools are built and managed by the Poor Law Guardians, who are responsible to the Local Government Board, by which body a new building has to be approved. There are of course a considerable number of ways in which Guardians can deal with the children of the occupants of the Workhouse. The desirability of separating them from the adult paupers is now well recognised, and the old Workhouse School in which the children were taught while living with their parents in the Workhouse has now practically ceased to exist. At the present time the children are either boarded out in ordinary working-class families, or placed in Isolated or Scattered Homes under the care of a man and wife appointed by the Guardians, and attend the ordinary Elementary Schools; or else they are collected into large schools,* either on the "Barrack School" or "Cottage Home" system, but which are complete in themselves. Each of these systems has strong supporters, and meets with equally strong opposition. The objectors to the large schools say that the aggregation of a large number of inmates in one building is bad hygienically; that the life is dull and tedious; that they destroy all individuality and stunt the faculties; and so turning out children who when they leave are helpless, incapable of making their own way in the world, and marked with the pauper taint. But while this may be true of the older type of school, no one who visits one of the large Poor Law Schools at the present day and sees the care and interest taken in the children can fail to be favourably struck. The children look bright and alert; they have numerous interests—cricket matches with neighbouring schools, expeditions, the school band, carpenter's shops, &c.—while the superintendent has usually any number of proofs of the after-success of the children. The "Cottage Home" system was introduced as an attempt to remedy what was supposed to be a defect in the best managed "Barrack" School, *i.e.*, the loss of home life. The idea of this system is that a small number, generally from 15 to 20 children, should be placed in separate cottages under the charge of a man and his wife, who are known as the "foster-parents," and who are supposed to give them the

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* Two or more Unions may arrange to join together in supporting a common school.

feeling of home which is thought to be so important. The resemblance to home is probably more imaginary than real, since usually the sexes are divided, and there are often 30 children in a cottage. The number is of course often much smaller, being sometimes as low as 10, but even then, as the school makes a complete colony within its boundary, the institutional feeling is only to a small extent got rid of. The separation of the boarding-houses is naturally a great advantage from the point of view of health. A careful consideration of the relative advantages of the different systems will be found in "Children under the Poor Law," by Mr (now Sir William) Chance, Bart., in which some figures given as to the cost of maintenance of Barrack Schools and Cottage Homes seem to show that there is not a great deal to choose between the two systems on the score of expense.* The Local Government Board have, however, now definitely decided in favour of the Cottage Home system, and strongly discourage the building of Barrack Schools.

The Buildings and Grounds.—The Local Government Board have formulated some general principles upon which such buildings should be based, but, perhaps wisely, as there is so much difference of opinion, have not laid down any regular code of regulations, but an early application to them for an opinion will probably save much trouble in obtaining the necessary certificate afterwards.

The Site.—As these schools are generally placed out in the country, and are not necessarily within the area of the Unions they serve, it is possible to choose some place where ample space can be secured, with free surroundings. The actual area would vary according to the kind of school. For a "Cottage Home" School Mr Gordon Smith † suggests an allowance of about 7 acres for each 100 children—giving one-third of an acre to each cottage for 15 children—while a school of 300 would require about 6 acres for football and cricket grounds. In the case of a "Barrack" School, as the buildings would be close together, less would be required, but it should probably not fall much below 12 to 15 acres. This is exclusive of farm land. The arrangements for recreation and exercise should be ample and attractive, as the children of this class, not taking naturally to games, require much encouragement. It not infrequently happens that the best part of the ground is devoted, in preference to this, to the growing of potatoes

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* Children under the Poor Law, p. 142.

† Suggestions as to the Planning of Poor Law Buildings, p. 15, P. Gordon Smith.

and other produce, to the detriment of the physical recreation of the pupils.*

In the dormitories the width usually allowed is 18 ft. In this case the Local Government regulations require 3 ft. 9 in. of wall space and 36 sq. ft. of floor space. If the width is reduced to 15 ft., 4 ft. of wall space must be provided. These measurements cannot be considered sufficient for healthy conditions in a sleeping room.†

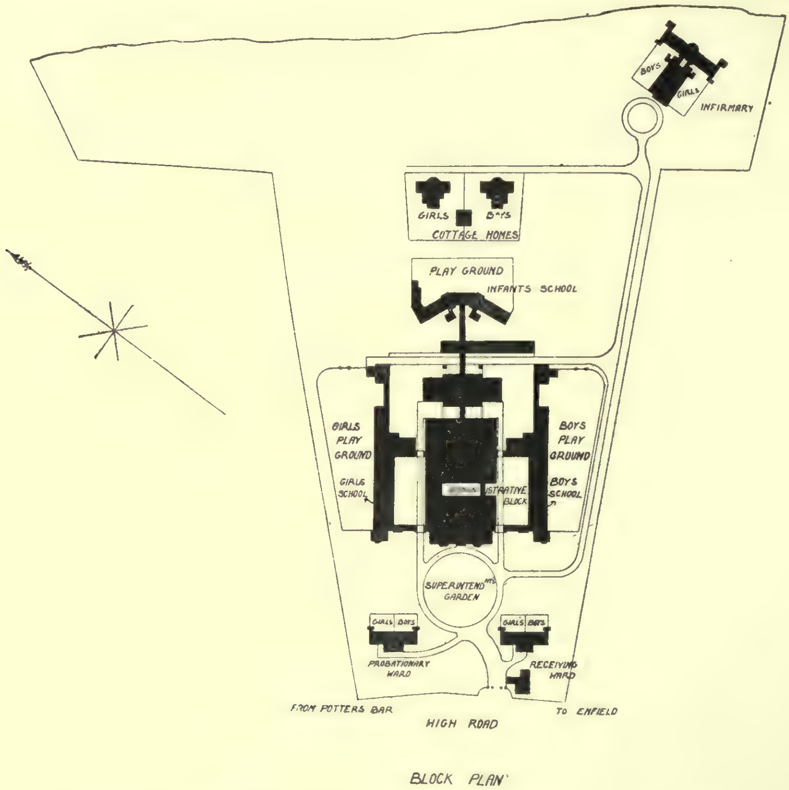
The danger of infection is one of the difficulties to be provided against in these schools where large numbers of children are collected together. Great care is taken by means of probationary wards to make sure that children entering the school do not bring in any infectious diseases with them. In regard to the arrangements for ablutions, precautions are taken to ensure against the possibility of the same water serving for two children, by the use of sprays of running water in place of basins. A description of various methods that can be employed for the rapid washing of large numbers is described on page 417. The sanitary arrangements are usually placed in a detached building which should always have a covered or well-sheltered approach. The closet accommodation laid down by the Local Government Board is for girls 15 closets per 100, for boys 10 closets per 100 and urinals in proportion. There is subjoined an example of a "Barrack" School and a "Cottage Home" School.

The Chase Farm Schools, Enfield.—These schools belong to the Edmonton Union. The general scheme will be easily understood from the block plan (Fig. 354). Immediately to the right of the entrance gate stands the porter's lodge. Behind this is the receiving ward, with the probationary wards on the opposite side in which the new arrivals undergo a fortnight's or three weeks' quarantine before being admitted into the school. It often happens that children never get beyond this stage, if their parents may only remain in the Workhouse for a short time, as they are bound to take their children with them when they discharge themselves. The main block of the building is shown in more detail in Figs. 355, 356. The general scheme groups all the administrative rooms and buildings that are common to both the girls and boys in the middle, while the dormitories, day-rooms, and class-rooms are arranged in two long narrow buildings on each side, connected by corridors with the main block at two points, the girls on one side, the boys on the other. The Infant School is placed in a detached building behind with its

* See Treatise on Hygiene and Public Health, p. 703, Stevenson and Murphy.

† See above, pages 240, 241.

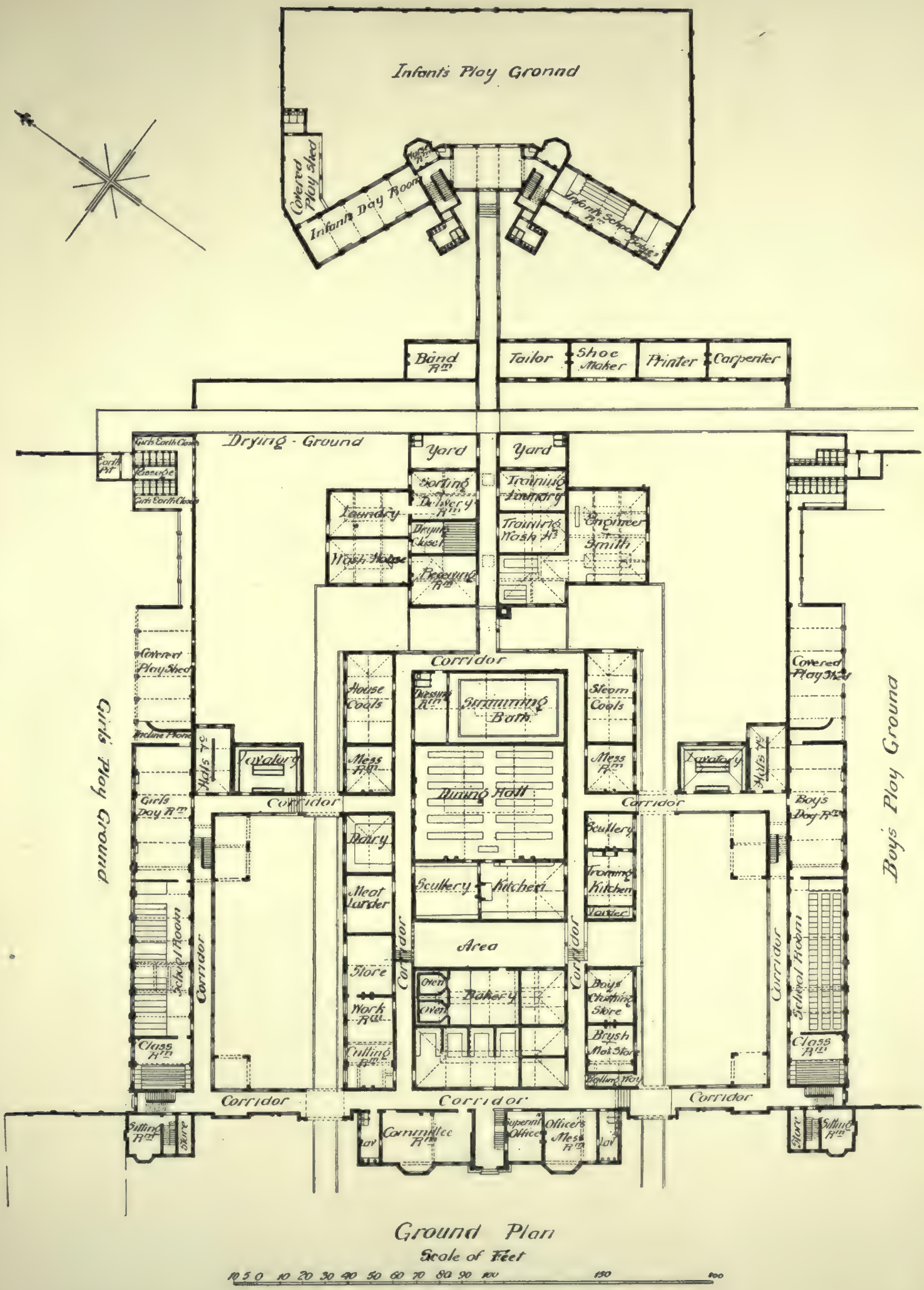
separate playground, &c., but also connected by a corridor to the rest of the buildings. In the front of the administrative block are placed the superintendent's room, committee room, behind these coming the offices, store-rooms, kitchens, &c. These have to be numerous owing to the fact that everything required by the school and the children is made on the premises. These tailoring, bootmaking, carpenter's shops, &c., enable the trades to be taught to the boys in addition to supplying what is required for the school. The living-rooms for the



354. Edmonton Poor Law Union, Chase Farm Schools.

children consist of the necessary class-room accommodation, and a large day-room opening through a covered playshed on to the playground. The arrangements correspond on each side for the boys and girls.

The dormitories are arranged to take twenty-two beds, in rooms separated from each other by open arched corridors, so that any one can be easily isolated if necessary. The corridor which connects them with main building is also open, so that the air can circulate freely all round the buildings. The dormitories are made 25 ft. wide, and are

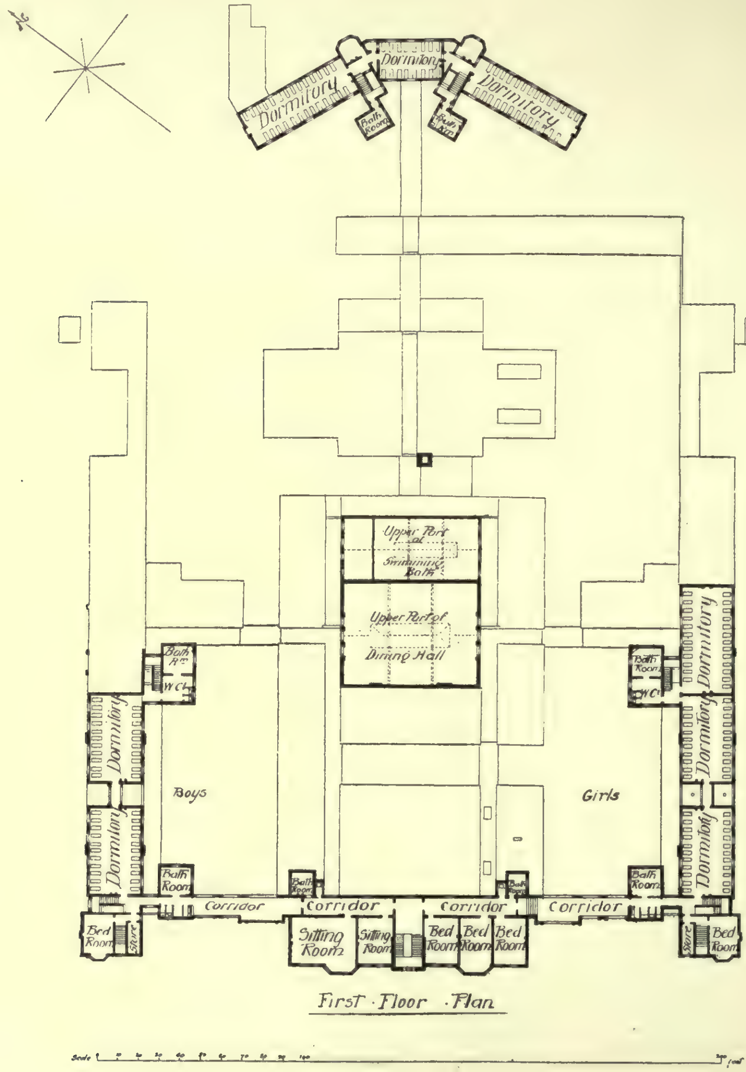


Ground Plan
Scale of Feet

355. Chase Farm Schools, Enfield.

Edmonton Poor Law Union. *T. E. Knightley, Architect.*

40 ft. long, thus giving an allowance of 45 sq. ft. per head, an amount which is above that demanded by the Local Government Board. Bath-rooms and W.C.'s are arranged in small spur buildings conveniently to each dormitory.



356. THE CHASE FARM SCHOOLS.

At a little distance from the main building (see Fig. 354) are situated the infirmary and two Cottage Homes. The latter are used for the purpose of training girls for domestic service, in order to give them some idea of what a small house is like, for many of the children

have spent their whole life in the school, and have perhaps never been inside an ordinary house. The whole scheme is compactly and carefully planned, and the superintendent spoke warmly of the suitability of its general plan and arrangement. A general view of the front of the building taken from a photograph is shown in Fig. 357.

The Cottage Home System.—In designing the cottages for a school on this system it should be remembered that the intention of this sort of school is to make the conditions approximate as closely as possible to those of the homes of the working classes, so that nothing more should be supplied than may fairly be expected in the ordinary artisan's dwelling. As regards the size of the bedrooms, the following

357. THE CHASE FARM SCHOOLS, ENFIELD.
T. E. Knightley, Architect.

dimensions will probably suffice. In the case of cottages which are not intended to take more than 15 children, bedrooms to take about 6 children should afford from 30 to 36 sq. ft. of floor area, the height being not less than 9 ft. In the case of rooms to take 10 or 12, the height must be increased to 10 ft., and the floor area should be at least 36 sq. ft.* In the small cottages for, say, less than 15, it is not necessary to provide a separate room for the foster-mother, as the children are not in during the greater part of the day and go to bed early. One living-room will also serve for meals as well as a sitting-room. Mr Gordon Smith suggests that it is an unnecessary expense to supply

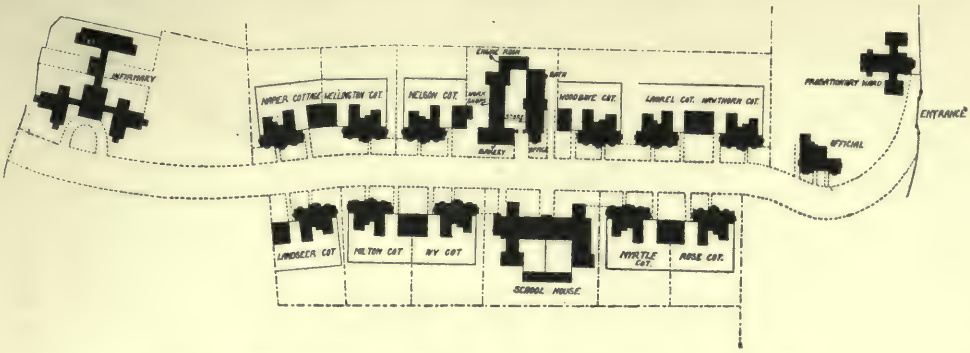
* Suggestions as to the Planning of Poor Law Buildings, pp. 16, 17, P. Gordon Smith.

358. The Hornchurch Cottage Homes. View down the Centre of the Cottages.

359. The Hornchurch Cottage Homes. View of the Educational Block.

The Shoreditch Union. *Francis Smith, Architect.*

elaborately fitted bathrooms and lavatories, since with the small numbers quite effective ablutions can be made with the ordinary wash-bowls that would be found in a workman's cottage. Arrangements for baths for

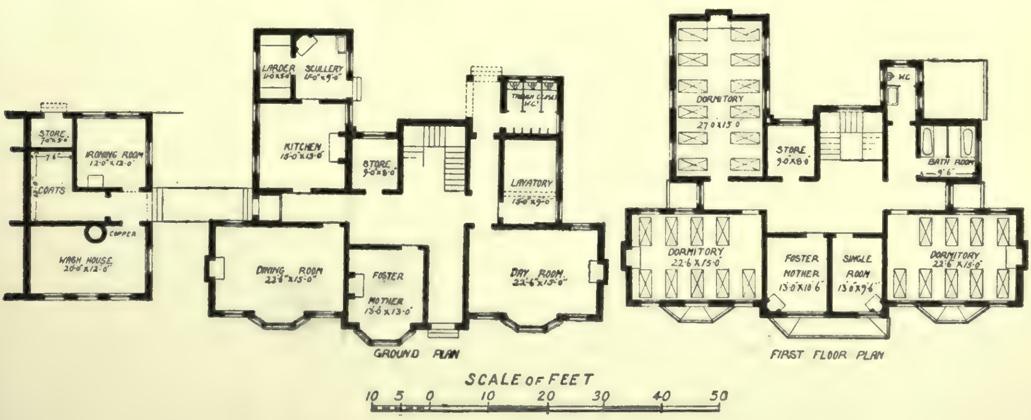


360. Hornchurch Cottage Homes. Block Plan of Site.

Francis Smith, Architect.

the children can usually be made by the provision of ordinary hip-baths or washing-tubs.

The Hornchurch Schools belonging to the Shoreditch Union will give a good idea of the general scheme of this class of school. The buildings are arranged on two sides of a road and form a small street



361, 362. The Hornchurch Cottage Homes. Detail of one Cottage.

Francis Smith, Architect.

(see Figs. 358, 360). Close to the entrance is placed the probationary ward with fourteen beds, and near this the official's residence. There are eleven cottages, each of which takes 30 children. Of these six are for boys over seven, the remaining five for girls and boys under seven.

The school buildings comprise the necessary class-rooms (see Fig. 359), &c., for education on one side of the road, and on the opposite are workshops for bootmaking, tailoring, carpentering, &c., in which the boys are taught the different trades. There is also a swimming bath, and a short distance off a well-fitted infirmary. There are in addition to this, not shown on the plan, two infirmary cottages placed well out of the way, one of which is used for ringworm and skin diseases, the other for ophthalmic cases. Any case of serious infectious disease that occurred would not be treated at the school, but sent to one of the Fever Hospitals. A plan of one of the cottages is shown in Figs. 361, 362. The single bedroom in the girls' cottages is used for the girl who is going out to service next, so that she may learn the looking after and tidying up of the ordinary servant's bedroom. An expenditure of £50,000 was authorised by the Local Government Board for the erection of these schools, which are certified for 337 children.

For further examples of Church Schools and Village Schools, see—

Note.—Large sized figures refer to volumes, smaller to pages.

The Builder.—38, 515, 570, 600; 40, 602; 41, 25, 140; 42, 734; 44, 74; 45, 146, 433, 752; 50, 302; 56, 146; 57, 192, 388; 62, 140; 67, 82, 434; 72, 442; 75, 558; 79, 366.

The Building News.—38, 540; 39, 384; 43, 354; 48, 88, 970; 51, 800; 52, 554; 53, 244, 860; 54, 617; 56, 719; 57, 252, 286, 318, 386, 482, 679; 58, 64; 59, 178, 818; 63, 629; 64, 503; 66, 377; 67, 517, 605; 69, 481, 739; 70, 130, 600; 72, 631; 74, 266; 75, 679; 76, 8, 777, 841; 77, 193; 79, 807, 913; 80, 175, 693, 797.

The British Architect.—16, 392; 52, 58; 54, 93, 165.

WESLEYAN SCHOOLS.

The Builder.—39, 322; 51, 874; 56, 432; 59, 499.

The Building News.—46, 672; 62, 77; 69, 151; 73, 113, 825; 81, 655.

INFANTS' SCHOOLS.

The Building News.—40, 232; 58, 830; 67, 319; 70, 327, 489, 858; 75, 409; 78, 190; 81, 417.

INDUSTRIAL SCHOOLS.

The Builder.—58, 435; 71, 57; 74, 321.

The Building News.—38, 100.

The British Architect.—43, 39.

PART III.

THE HYGIENE OF SCHOOLS.

PART III.—THE HYGIENE OF SCHOOLS.

CHAPTER XXII.

VENTILATION AND HEATING.

Difficulty and importance of subject — **Ventilation** — Ventilated and Unventilated Schools—Necessity of Knowledge upon the part of the Teachers—Composition of Air—Causes of Vitiation—Dust—Amount of Air necessary—The Size of Rooms in reference to their Ventilation—The Circulation of Air in a Room—Different Systems of Ventilation—Downward and Natural Methods—Comparison of the two—Inlets and Outlets, their Size and Position—Tobin's Tubes—Figures showing behaviour of Air according to position of Inlets and Outlets—Size of Openings—**Heating**—Temperature for Class-rooms—Different Methods of Heating—Grates—Stoves—Radiators—Warming by the admission of Hot Air, Reasons against—Methods for controlling the Heat—Description of the Plenum System—Conclusions as to the Ventilation of Large Buildings and of Small Schools—Ventilation by Windows only.

SCHOOLS are an extremely difficult class of building for which to supply ventilation and warming that shall be efficient and reasonably economical. The rooms are usually many in number, differ considerably in character—from class-rooms to laboratories and large halls—and have a continually varying number of occupants. At the same time the importance of proper and effective ventilation cannot be overrated. It is hardly too much to say that the success of a school, educationally as well as physically, will to a considerable extent be dependent upon the efficiency of the ventilation and heating.

The lassitude and lack of interest, the inability to concentrate the attention, and the loss of energetic mental application, due to working in a vitiated air, are too well known to require any repetition here. Yet in spite of the denunciation of writers on hygiene, and the continual discussions of the subject, the state of the air in schools is usually very far from what it should be: expense as well as the difficulty has no doubt a good deal to do with this. But as Dr Newsholme remarks—"Although pure warmed air mechanically propelled into school-rooms

costs money, it repays the additional expenditure in improved health and power of work. Dr Wheatly states that at Blackburn a large manufacturer by adequately ventilating his weaving sheds increased his output $2\frac{3}{4}$ per cent. Dr Carnelly's well-known report mentions the fact that among 9 mechanically ventilated schools the average Government grant earned per head was 21s., among 95 naturally ventilated * or unventilated schools it was only 18s. $3\frac{1}{4}$d.; and a portion at least of the explanation of the differences in grant-earning power of the contrasted schools lies in the proved excessive impurity of the air in the latter." †

If some such difference were conclusively proved to be the direct result of improving the ventilation, it would be an interesting calculation to work out as to whether it would not be actually a good investment, from the money point of view alone, for School Managers to ventilate their schools effectually.

Probably one of the great hindrances to a more universal insistence on the proper ventilation of rooms lies to a large extent in the fact that the deterioration in the air is invisible, and for a long time imperceptible to the persons using the room; a room which appears excessively stuffy and close to a person coming in from outside may seem quite comfortable to those actually in it; and also that the bad effects, although directly due to the use of badly ventilated rooms, are usually attributed to other causes, unless the conditions are so bad as to produce immediate headache or discomfort.

The colds and coughs common in schools, which are usually attributed to draughts, are probably much more due to the lack of them. A window opened suddenly in a hot and crowded room is of course a source of great danger, but provided that the air is fresh and the custom of keeping the windows open is begun in the summer, it will be found possible to keep the windows open nearly all the year round in this climate. In the open-air cure for consumption the windows are usually removed all together, so that there should not be anything so very dangerous to persons in health in an open window, provided they are warmly clad. It should be remembered, too, that the dangerous form of draught is caused by a small opening into a warm room which causes the air to enter at a great pace, so that a

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* It is only fair to note in these comparisons that the expression "naturally" ventilated schools usually mean buildings in which no precautions have been taken for ventilation at all, or at the best those in which a few inlet tubes have been supplied.

† Paper read to Sanitary Institute, June 1900, "The Healthy Scholar."

widely opened window is not only safer, but often prevents the feeling of draught.

"It seems to be important in the case of class-rooms to maintain a rather high and even temperature, else one would suggest that in the smaller schools, especially in the country, all the windows on one side, or even the whole of one wall, might be removed, and the children keep themselves warm with extra clothing." * Without going quite so far as that, it may be worth while pointing out that the high temperature required in class-rooms is usually due to lack of ventilation. A feeling of chilliness is felt when there is a certain degree of impurity in the air, in a temperature that seems comfortably warm with a proper supply of oxygen. While it is no doubt true that the cold air or draught is the actual inciting cause of colds, &c., it is the loss of the power of resistance due to impaired vitality caused by sitting in ill-ventilated and often over-heated rooms that render the victims such an easy prey.

It is curious to reflect on the reliance which is placed on the power of the cracks under the doors and the crevices round the windows. It has been estimated that in an ordinary class-room all the occupants would be dead in about half an hour were all opportunities for ingress of air hermetically sealed up.†

A great step will have been gained when it is more fully recognised that although there may be some risk in open, there is undoubtedly more in shut windows, unless some other means for the provision of fresh air are provided. But until there is a strong public feeling on the subject it is not likely that much will be done. As the late Sir Douglas Galton said, "If the opinion was only equally spread through the community that bad air was detrimental to health, if the fact that a room being close and stuffy was regarded as disgraceful, if people refused to attend dinner parties where the rooms were filled with bad air, the architects, the builders, and the occupiers would soon find means that every room should be pure and of a comfortable temperature."‡

An interesting and instructive incident is mentioned in a small handbook on ventilation, by the late Professor Jacob.§ In some French cavalry stables the mortality of the horses was reduced from 197 to 20 per 1,000 by simple ventilation. Again, to quote from Major Fisher ¶—"A horse seldom takes a 'cold' from exposure to cold,

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* *The Edinburgh Review*, The Fight against Consumption, October 1901.

† Ventilation of School Buildings, p. 12, G. Morrison.

‡ Healthy Dwellings. § Ventilation and Warming.

¶ Through the Stable and Saddle-Room.

but frequently is made ill from being too warm. It is the *inside* not the outside air that gives them coughs, sore throats, congestion of the lungs, and sundry other ills to which horse flesh is heir." If we substitute human for horse flesh, these remarks will lose none of their force.

It has been thought well to discuss somewhat in detail the elementary principles underlying the different systems and methods of ventilation, in the hope that it may be of use to some of those teachers who, having had no opportunity of making themselves acquainted with the subject, are so very apt, either from carelessness or in the hope of improving the state of things in their class-rooms, to spoil or render quite useless any provisions that may have been made for the purpose of ventilation.*

No scheme will ensure the proper warming and ventilation of a building unless it be intelligently used. Tobin tubes or other ventilators may be supplied, but they will be found to be usually closed, and commonly used for the purpose of a waste-paper basket. It is, however, only fair to add that a badly arranged inlet may cause such unpleasant draughts that any means to stop it are justifiable.

The Composition of Air.—Pure air, before being breathed, consists of about 21 parts of oxygen to 79 of nitrogen in 100, some watery vapour, a trace of ammonia and carbonic acid to the proportion of 4 parts in 10,000. Expired air contains about 5 per cent. less oxygen, and carbonic acid in the greatly increased proportion of 470 parts in 10,000, and is also raised in temperature to nearly the heat of the body, viz., 98°, and is saturated with moisture.

Carbonic acid is a heavy gas, and will, if allowed sufficient time, mix uniformly with the air. It is, however, quite fallacious to assume on

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* An incident which happened within the writer's knowledge will illustrate this. In a certain class-room, which was a room in an ordinary dwelling-house converted to school use, having three doors and warmed by an open fireplace, two Sherringham ventilators had been placed for the admission of air. One morning, the weather turning cold, these were shut, and a draught being felt from the doors, two which were not absolutely necessary were fastened up, being finally, as the draughts got worse, pasted completely over. When this was done the draught from the remaining door to the fire was unbearable, and such strong complaints were made that the advice of an expert was obtained. The remedy was as easy as the explanation was obvious. By opening the ventilators wide, and lighting the fire in good time in the morning, the difficulties both of warmth and draughts were settled. The fire being able to draw its necessary supply of air from various points was no longer forced to draw a strong current from the only available source, the door.

this ground, as is sometimes done, that the bad air in a room will be found near the floor. On the contrary, the expired air, although heavier than air at the same temperature, is raised by breathing to a warmth so much in excess of that of the surrounding air, that it rapidly rises and then begins to diffuse itself evenly through the room. This is indeed a matter of common observation, for instance, when going into a gallery or upper part of a crowded hall; but it is a fact not infrequently lost sight of. Carbonic acid or carbon dioxide is not itself an actually poisonous gas, and death would ensue if a person were placed in an atmosphere containing this gas in too large a proportion, merely from want of the necessary oxygen. There is among physiologists no decided agreement as to exactly what impurity in the air should be attributed to the deleterious effects of crowded rooms. But whether the effects are to be attributed to the organic impurities in expired air which certainly have a perceptible and disagreeable odour, or to the excess of carbonic acid, or simply the lack of sufficient oxygen, there is no doubt of the evil results arising from overcrowded, ill-ventilated rooms, and the term "crowd poison" has been used to denote this. In order to test the purity of the air it is customary to estimate the proportion of carbonic acid, as this will at once show to what extent the air has been breathed, and this may be considered a fair test of other impurities; as it has often been shown by different investigators that the organic impurity in the air increases in a constant proportion with that of carbon dioxide. So that, knowing the amount of carbonic acid present in the air, we shall have a quite sufficiently accurate idea of its condition. Authorities differ as to the greatest amount of carbon dioxide that ought to be permitted. It is quite certain that no unpleasant sensation is experienced until the amount is increased to 10 or 12 parts in 10,000, yet authorities are generally agreed that the maximum amount should not exceed 10 parts in 10,000. The standard of good ventilation usually adopted at present would permit about 6 to 8 parts in 10,000 in the air.*

The amount found in the air in the open country is from 3 to 5 parts per 10,000, and it is usually reckoned as 4 for the purpose of a standard measurement.†

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* Heating and Ventilating Buildings, Carpenter, p. 26.

† A simple plan for estimating roughly the proportion of carbon dioxide may be of use:—

Six stoppered bottles are taken, containing respectively 450, 350, 300, 250, 200, 100 cubic centimetres. These are filled with the air of the room which is to be tested by means of a small handball syringe. A pipette, holding exactly 15 cubic centimetres, is then filled

Other Causes of Vitiation.—Besides the rise in temperature caused by a number of persons crowded together, from the expired air and the heat thrown off by the body, there is a constant accumulation of water vapour, and the sense of discomfort and oppression felt in a crowd is probably in a great measure due to the latter; the undue proportion of moisture in the air, by preventing the proper evaporation from the surface of the body, deranges the action of the skin, and when evaporation is retarded to a sufficient extent, a rise of internal temperature succeeds. It is generally observed that cases of sunstroke occur in the greatest number where there is combined with great heat a high degree of humidity in the air. Dr Billings suggests that the great difference in the standard of temperature * at which rooms are kept in this country and in those in America may be to a certain extent due to the much greater dryness of the air in the latter country, as well as to custom and habit.

In addition to carbonic acid, organic matter, and moisture from the results of breathing, and the water in organic salts and fatty acids given off by the skin, there are other factors which play a part in vitiating the air, among the most important of which may be considered dust. In school buildings, from the great amount of movement, dust is one of the most serious and difficult problems to deal with successfully. It rises in great quantities from the floors of the class-rooms, it is kicked up in the corridors, and finds resting-places in the joints of the woodwork, floors, and corners till stirred up again. To these particles of dust are attached floating bacteria in considerable quantities, and while not all these bacteria by any means are injurious, there is probably a

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with clear transparent lime water, emptied into the smallest bottle, and well shaken. If the fluid becomes turbid, the amount of carbonic acid will be at least 16 parts in 10,000. If there is no result with the smallest bottle, the next is tried, the results being shown as follows:—

If the	100	cubic	centimetre	bottle	becomes	turbid,	16	parts	in 10,000.
„	200	„	„	„	„	„	12	„	„
„	250	„	„	„	„	„	10	„	„
„	300	„	„	„	„	„	8	„	„
„	350	„	„	„	„	„	7	„	„
„	450	„	„	„	„	„	6	„	„

In order to judge of the turbidity, mark a piece of paper with a lead pencil, and gum it to the bottle with the mark inwards. If there be turbidity the mark will be invisible. This is of course only a rough test, but one which can very easily be tried, and which is sufficiently accurate for ordinary purposes.

* See *post*, page 401. The standard temperature for class-rooms in America is usually given as 70°.

certain proportion which consist of the germs of diphtheria, tuberculosis, &c. The difference in the number of germs found in well-ventilated rooms compared with those not so well arranged is very striking. For instance, Professor Carnelly gives the following results of his examination in Aberdeen and Dundee.* In the first town he examined 42 "naturally" ventilated schools, *i.e.*, without special apparatus, and found the number of micro-organisms per litre to be 136, and in 39 similar schools in Dundee the number was 152. On the other hand, in the 12 mechanically ventilated schools in Aberdeen and 25 in Dundee, also examined, the numbers were 20 and 17 per litre respectively.

Another cause of the deterioration of the air occurs in the use of various forms of artificial illumination. These have been already treated at length.† There is also during combustions of oil or gas a certain amount of carbon monoxide given off, which, in distinction to carbon dioxide, is an actually poisonous gas, so that considerably more provision for ventilation is necessary for rooms that are to be used for night as well as day work. Gas burners are usually reckoned as equal to five persons in estimating the amount of air required for ventilation.‡

Standard of Purity required.—The amount of carbonic acid that may be allowed in rooms without any injurious effects or perceptible odours is generally reckoned as 6 parts in 10,000, that is .0002 in excess of that in ordinary country air. On this amount there is a fairly general agreement. A fair average of the CO_2 given off is for adult males, 0.6 to 0.7 cub. ft. per hour; females, 0.4 to 0.5. Parkes adopts 0.6 cub. ft. per hour as an average for mixed assemblies. Dividing the limit of permissible impurity by the amount of carbonic acid exhaled in an hour, we have $\frac{0.6}{0.0002}$, giving 3,000 as the amount of cubic feet of air required per hour per person, and this is the standard usually adopted. This is, however, rather in excess of what is necessary for school children, and Dr Billings, in his book on "Ventilation and Heating," gives 2,400 per head per hour as the amount that should be allowed. It should be noted that this is on the understanding that the effects of respiration are not carried off directly, but merely mixed with the air, which requires dilution by the addition of so much fresh

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* Conspectus of the Air in 85 Schools, by Professor Carnelly (*Journal of Pathology*, November 1893), quoted by Professor Jacob in "The Ventilation of Buildings."

† Page 114, The Artificial Lighting of Class-rooms.

‡ Heating and Ventilating Buildings, Carpenter, p. 2.

air. When the vitiated air is carried straight off, a very much smaller supply of air would be sufficient, having been fixed as low as 1,000.

But even when the downward system of ventilation is used, in which the foul air is carried off at the bottom, fair ventilation can be obtained with less than the 2,400 cub. ft. The Massachusetts law requires 1,800 cub. ft. per hour per pupil, and where this standard is maintained there will certainly be no perceptible effects of want of ventilation. Taking then a class-room 25 by 30 ft. and 13 ft. high, and containing 40 pupils, the air would have to be completely changed once in about 8 minutes, or allowing that the air is changed once an hour by natural ventilation through the wall, crevices, &c., once in 9.6 minutes. Hittenkofer found that a room in which all the windows and crevices had been closely pasted up, when there was a difference of 40° between the inside and outside temperature, that the change of air by diffusion through the walls amounted to 7 cub. ft. per hour for each square yard of wall surface.* This form of ventilation is too uncertain in amount and character to be reckoned in calculating the amount of air required for ventilation.

The Size of the Room.—The cubic capacity of the room and its shape have of course a considerable influence on the question of its ventilation, but this influence is often overestimated, and even in a large room, if no fresh air is supplied, the atmosphere will quickly fall below the standard of purity desirable. One of the commonest fallacies in regard to ventilation is that a high room is necessarily better ventilated, and that if the requisite amount of cubic space be made up in height, all will be well. As a matter of fact this is not in any degree the case. The additional height that is often provided in class-rooms, while considerably increasing the cost of the building and the length of the stairs, is, as far as ventilation is concerned, not only a complete waste of space, but considerably adds to the difficulty of both warming and ventilating the room. As Dr Billings, whose opinion is naturally of great weight, remarks, "In computing space for purpose of ventilation, heights of rooms above 12 ft. should be disregarded." † In fact, the only advantage of making class-rooms of a greater height is for the purpose of effectively lighting the side farthest from the window, when of sufficient breadth to require it. Large rooms, *i.e.*, in the sense of a large superficial area per head, are of course easier to ventilate, more air can be admitted and at a greater pace without causing any

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* Carpenter, p. 35. † Heating and Ventilation, p. 135.

inconvenience from draught, as it is generally possible to arrange that the inlets shall be at a sufficient distance from the nearest seats. But it is as well to bear in mind that the size of the room will make very little difference with regard to the necessity of providing for the admission of fresh air or to the amount to be supplied. The following table, which is often quoted, shows the time it takes to reduce the air in a room to a condition in which it contains 12 parts of carbon dioxide in 10,000. The figures are of course only approximate, since air is always entering more or less through cracks and crevices.

Class of Building.	Cubic Capacity per Head.	Time required to contaminate the Air.
Hospital - -	1,200 cub. ft. and above.	70 minutes.
Middle-class House -	1,000 " "	59 "
Barracks - -	600 " "	35 "
Good Secondary Schools	260 "	16 "
Elementary Schools -	130 "	8 "

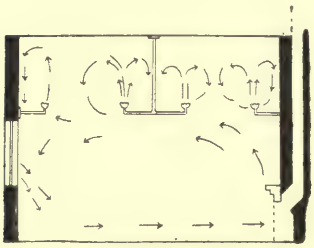
This is allowing in the case of Secondary Schools 20 sq. ft. per head, presuming the rooms to be 13 ft. high; in the Elementary 10 sq. ft., as laid down by the regulation of the Board of Education.

It would be well that this should be borne in mind when the question of class-room accommodation is under consideration, for were the extra expenditure so often incurred by giving a lavish allowance of floor space devoted to the provision of more effective means of ventilation, the result would often prove more satisfactory.

The Circulation of Air in a Room.—It is not possible to show with any accuracy the line taken by the air entering a room, and so follow its course through from the inlet to the outlet. Innumerable eddies and cross currents are set up by local sources of heat, or by friction against obstacles, while the diffusion of the incoming air with that in the room rapidly destroys any line of demarcation. In a close room, heated by hot-water pipes, there is a continual circulation of air, but the movement is of course confined to the same air, so that the conditions will soon become very bad. In an ordinary room, heated by an open fire, with fresh air entering either by open windows or through inlet tubes or the crack and crevices left in the closed door and windows, the general circulation will consist of a rapid entering current of cold air at the inlets with an equally rapid movement out up the chimney, with a cold layer of air from 1 to 2 ft. thick moving towards the fire, which will be affected by the various objects warmed by radiation from the

fire. In the case of a similar room with a number of gas-jets fixed at the same level, as in a class-room, there are as it were three nearly independent planes of circulation. The heat of the gas-jets set up a strong local circulation which does not extend below the plane of the jets. The movement is shown approximately in Fig. 363. The air above the line of gas-jets would be very bad, while the best air would be that nearest the floor. Where the admitted air is of the same temperature as that in the room, it merely diffuses itself without taking any particular direction.

Different Forms of Ventilation.—In order to secure ventilation of any kind, provision must be made first for some power to keep the air in motion; and secondly, for sufficient inlets for the admission of fresh air, with corresponding outlets for the escape of the vitiated air. The movement of the air can be produced either by the expansion due to heating, or mechanically by the use of fans. In the first case the movement is due simply to the difference in weight between hot and cold air. The former, being lighter, rises and flows out of one set of flues, its place being taken by colder air coming in at the bottom. This is known usually as the "natural" or "gravity" system.



363. Showing Circulation of Air, after Shaw.

A fact that seems often lost sight of is that the system of ventilation has to provide for the effective change of the air under two almost opposite conditions—in winter, when the outside air is at a lower temperature than that inside the building, and in summer when the conditions are reversed. In some of the more recently erected schools in Switzerland the engineers have provided a double set of extract openings. The difficulty of summer ventilation can be easily met in this country by having a plentiful supply of windows that open, and means of establishing through currents of air.

Mechanical ventilation by means of fans is performed in two ways, by pressure and by suction. In the former, the air, being forced into the rooms under pressure, escapes naturally in the direction of least resistance, that is outwards to the atmosphere; in the latter the fans are used to draw out the inside air, and so induce a current of air from outside to supply its place. These systems are known as the "Plenum" and "vacuum" systems respectively. Sometimes a combination of the two is successfully used. In both cases when mechanical ventilation is used the air is moved without any reference to change of temperature,

and the force used must be sufficient to overcome any disturbance due to this cause or to wind. There are certain objections brought against the "vacuum" or exhaust system. When used alone, it is difficult to control the movements of the vitiated air. The opening of a window, a door, or a badly-fitting window in one room, will upset the ventilation all over the building, since the supply of air to the exhaust fans will naturally come from the place whence it can be drawn most easily. Another grave objection has been occasionally found—the air may be drawn in through the water-closets and lavatories, giving rise to unpleasantness and to serious danger when there is any defective plumbing work. As Mr Wheelwright, the writer of a recent book in America on School Building, says—"In more recently constructed schools the exhaust fan is now rarely used, and then only for special purposes and conditions." *

The two systems then that we have to consider are the "Plenum" † or pressure system, where the pure air is admitted high up and the foul air extracted at the bottom; and the "natural" system, where the vitiated air is taken off through outlets arranged at the highest part of the rooms, the fresh air being introduced at a moderate height or at the floor level. There is a very great difference of opinion as to the relative merits of the two methods. It will be as well to briefly state some of the chief arguments usually advanced in favour of each system. In order to make the comparison in any degree a fair one, it is necessary to assume that in either case the incoming air is warmed, at any rate sufficiently to prevent its causing an unpleasant feeling of draught. To compare, as is so often done, a method which brings in warmed air with a system which only provides for the admission of cold air, in which case the ventilators are certain to be closed in winter, is manifestly unfair; and it is just as easy to provide that the supply of air shall be warm in the case of the upward or natural system, provided that it is of a lower temperature than the air already in the room, as it is in the case of the downward or pressure system. Probably no small part of the credit which the "Plenum" system has acquired is due to the continually published tables comparing the results obtained by that system with those in what are called naturally ventilated schools, but which should be called schools with no provision for ventilation, even though there may be a few Tobin tubes supplied. It would be in-

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* School Architecture, p. 264.

† For description, actual arrangement, and practical working of this system, see below, page 408.

teresting to see tables showing the comparative results of a well-arranged system of "natural ventilation" and the Plenum system.

For the natural or upward system of ventilation it is contended that as the vitiated respired air is of a considerably higher temperature than that of the surrounding air, it rises at once, and so should be taken off at the top, while in the downward or pressure system the pure air being introduced at the top, the air that has already been breathed is forced down again past the heads of those sitting in the room, though of course in a much diluted form, and so breathed again. Those sitting near the outlets are in a continual stream of bad air, as the downward action cannot be of sufficient strength to prevent the expired air rising at all without causing an intolerable draught. Again, in case of a room illumined by any form of artificial light, other than electric lamps, the heat helps to strongly increase the upward current, and so helps to carry its own noxious fumes away. On the other hand, with the downward system the unpleasant products of combustion have all to be carried downwards past the persons sitting below, unless some special and rather elaborate arrangements are made in the lighting apparatus.

It is further argued that with a downward propulsion of air perfect ventilation is impossible, as the vitiated air is not at once removed, but diluted; much on the same lines, it is suggested, as a water supply in which the water was returned to the reservoir after use, but with one that was of a sufficient size to make the impurity scarcely noticeable in the water when used again, while on the upward system the vitiated air is taken away, the fresh air only coming to the people in the room, and being available for breathing. So that in the case of the downward system the amount of air that has to be introduced is very great, since it has to be sufficient in quantity to dilute the air in the room to the degree that is supposed to be harmless. It is usually reckoned that at least three times the amount of air is required for the downward system than is necessary for the proper working of the upward method. In halls arranged with galleries there is great difficulty in so arranging the down currents that the vitiated air from the galleries shall not be breathed again by those in the main body of the hall, or that the fresh incoming air shall not be all drawn away to the galleries.

Further advantages claimed for the natural system are great economy in installation and in working, as nothing is required beyond occasionally cleaning the flues and slightly warming the incoming air, the impossibility of its getting out of order where once fixed from ignorant or careless use, and the avoidance of any necessity for a skilled man to look after it.

The upholders of the downward or pressure system maintain that the natural system, even where assisted by heat in the flues, is unable to maintain the necessary movement in the air, unless under exceptionally favourable conditions of the atmosphere, and that under certain conditions of wind there will be a complete failure of the ventilation, with sometimes strong and unpleasant down draughts, but that by placing the inlets for fresh air at the ceiling and the extract flues at the floor level a far better circulation of air through the room is obtained, while the opposite arrangement, *i.e.*, the inlet below and the outlet above will lead generally to a direct current from the inlet to the outlet, leaving large parts of the room unaffected; and that although in the downward system the air has to be brought down again, it is in so diluted a form that the unpleasantness is not only imperceptible but quite harmless, and even if this may be considered a slight defect, it should be far outweighed by the very great advantage of a system that will act with certainty under all conditions of weather or temperature. Finally, that the question of cost should not be allowed to have much influence, it being desirable to use the best means for obtaining pure air.

While each system has numerous and strenuous supporters, opinion generally seems turning rather in favour of a combination of the two, *i.e.*, that fresh, slightly warmed air should be propelled into the rooms under very slight pressure through inlets placed at a moderate height and well distributed, the vitiated air being taken off by large outlets high up. In this way it is urged that while retaining the many obvious advantages of drawing off the bad air at the top, the slight pressure that the air is under will ensure a sufficient movement under all conditions of weather and temperature. Further, that the opening of a window in one room will not interfere with the ventilation all over the building. Two important considerations have to be borne in mind. First, that very great care is necessary in determining the position of the outlets and inlets; and secondly, that the incoming air should be only warmed sufficiently to avoid any unpleasant sensation of draught, and should not be used for the purpose of warming the room.* In the case of many Secondary Schools where the classes are small and the rooms a fair size, in which it is impossible to go to the expense of the installation of any elaborate scheme of ventilation, it is possible by the judicious use of simple means, such as ventilating fireplaces and hopper windows, to obtain quite reasonably good air in the rooms.†

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* See below, page 405. † See below, on ventilation of small schools, page 411.

On the whole, it may, I think, be fairly concluded that in large buildings, where there are great numbers brought together, it is essential to have some form of mechanically worked ventilation ; but that in order to ensure that such a system will work properly, it is necessary to have a skilled engineer in charge of it, capable of making the necessary alterations and adjustments to meet the varying conditions of the weather ; but that in small establishments, by having a "natural" system installed under the superintendence of a really skilled engineer, and properly arranged, so that once in working order it will require no skilled manipulation, it will be found possible to keep the air in the rooms up to very nearly as good a condition as in the case of a mechanical system, provided that the apparatus is used with intelligence by those in charge of the rooms.

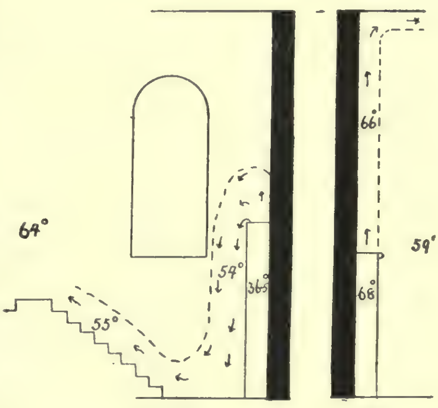
It must not be forgotten that while no doubt very admirable results may be gained by a properly designed and carefully worked mechanical system, the bad results arising from a badly conceived installation are often worse than none at all ; and as any openings in addition to the regular inlets and outlets will upset the whole scheme, it is not possible to open the windows either during or between lessons, whatever the weather may be. Again, although the apparatus is guaranteed to change the air in the room so many times, and while it can perhaps be shown that it pumps a sufficient quantity of air into the room to do this, it may easily happen, if the inlets and outlets are not properly situated, that the incoming air passes directly from one to the other, while the main bulk of the air in the room remains entirely unaffected.

A great deal of the support and writing in favour of the mechanical systems comes from America, where provision has to be made for a much larger range of temperature than is the case in this country. It is not unlikely that the popularity of the Plenum or downward system is to a considerable degree due to the strong support given to it by American writers on ventilation and heating, for owing to the necessities of the climate, and partly perhaps to their fondness for and great ingenuity in mechanical apparatus, the Americans have devoted far more attention to questions of mechanical heating and ventilation than this country. There has, however, been great readiness to adopt their methods and inventions, which, although they may be suitable or even necessary in America, are not required here to anything like the same degree. The Plenum system for its proper working entails the necessity of always keeping the windows shut ; but in a climate like that of England, it is only for a short time in the year that it is too cold to

allow of the outer air being brought in at its own temperature, and never perhaps to allow of the windows being opened during a recess when the class-room is temporarily unoccupied,* the result being that for large parts of the year when air might be allowed to enter freely by the windows, considerable expense is gone to to drive air through ducts and mains, often dusty and dirty, into the class-rooms, while all the windows in the building are kept rigorously closed.

Inlets and Outlets, Size and Position.—The size of an inlet is dependent naturally upon the amount of air to be admitted, and the pace at which it enters. In order to avoid a feeling of draught in the room, it is usually considered that this pace must not exceed 5 or 6 ft. per second. If it is necessary to introduce it at a greater speed, great care must be taken to so arrange the position of the inlet that the draught will not be felt by any one in the room.

The actual direction taken by the air on entering the room can be guided to a considerable extent by the shape of the inlet opening, *i.e.*, it can be given a turn upwards; but at the same time it must not be forgotten that it will behave in very different ways according to the difference between the temperature of the incoming air and that of the air in the room. In Figs. 364, 365, is shown from the results of actual experiments by Shaw† the behaviour of an incoming current of air through an upright tube of the form usually known as a Tobin's tube. In the first case (Fig. 364), the entering air being at a temperature considerably below that in the class-rooms, although entering at a high velocity, almost immediately falls and flows downwards in a cold stream. In the second figure (Fig. 365), the air coming in at a temperature higher than that in the room, rises directly to the ceiling. The first of these two figures is quite sufficient to explain why inlet ventilators of this kind are invariably found shut in cold weather.



364. 365.

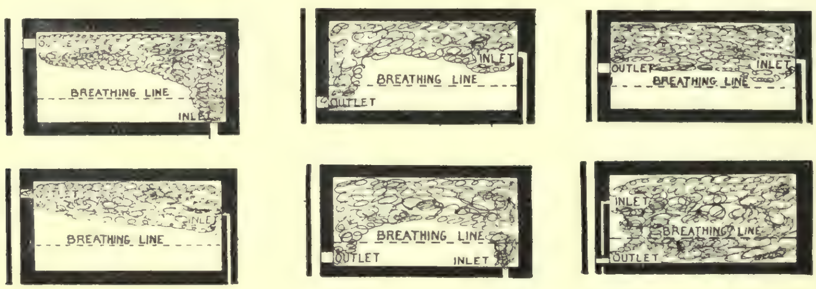
SHOWING THE BEHAVIOUR OF AIR ENTERING A ROOM THROUGH A TOBIN'S TUBE AT DIFFERENT TEMPERATURES.

* It should of course be noted that this method of airing entails a certain waste of heating power, as it allows the room to completely cool down.

† Warming and Ventilation, by Shaw, in "Hygiene and Public Health," Stevenson and Murphy.

An outlet flue should if possible be placed against a warm chimney flue or heated shaft of some kind in order to ensure an upward current. An iron pipe in a chimney is often used successfully. Short tubes projecting horizontally through the wall, which are sometimes put in, in the hope of their acting as outlets, are either quite useless for that purpose, except perhaps in the case of a strong wind from the opposite side of the building, or merely act as additional inlets.

The effect of corners and sharp bends or alterations in the bore of an air duct or flue is often insufficiently appreciated. The carrying capacity of the flue is in this way very seriously reduced owing to the formation of eddies in the corners, which to a large extent restrict the passage of the air. It is reckoned that a corner at a right angle will diminish by 25 per cent. the theoretical carrying capacity of the flue. Air shafts may not uncommonly be found whose effective carrying capacity has been reduced almost to nothing.



366-371.

A plan of ventilation sometimes adopted in halls of carrying the extract tubes into a false roof with openings to the air is not only quite useless, but productive of strong down draughts.

In the case of warmed fresh air introduced into the room under pressure, it is argued that the best position for the inlet is near the ceiling, on the grounds that as the incoming air is warmer than that already in the room it will tend to spread itself over the upper part of the room, and descending gradually will fill the room with fresh air without a draught, while the cooler air can be drawn out at the bottom. In support of this it is usual to find in books on ventilation figures showing a series of tests carried out by Mr Warren R. Briggs * when building the Bridgeport School, U.S.A. (see Figs. 366-371). These

* Modern American School Buildings. 1899.

experiments were carried out in a model one-sixth of the size of the rooms to which the system was ultimately to be applied. The incoming air was mixed with smoke in order that its movement might be visible, and the result shows that under the conditions of the experiment, undoubtedly the most complete dispersion was obtained where the inlet and outlet are disposed as in Fig. 371.

But although these experiments have been adopted as a very strong argument in favour of the downward system as giving the best and most complete diffusion of the incoming air, and appear, as mentioned above, in most of the recent works on the subject, it is at least open to question as to how far they are of value as a test of the behaviour of air in an actual building. First of all, size itself plays an important part in the behaviour of air movements. Eddies and currents might be set up in a model which would not at all necessarily be found in a full-sized room. The pressure, too, can be controlled when delivering air into a model in a way that would be quite impossible when it has to be supplied to a number of rooms at varying distances and heights. Again, the fact that a number of people expiring air at a considerable temperature (about 98°) would necessarily have a great influence on the result, seems to be neglected. The further influence of the cold air from the window panes and draughts under the doors, and the interference caused by furniture in the room, the occupants themselves and their movements, all seem to have been left out of account. Nor indeed is there any information given as to the difference of temperature in the model and that of the incoming air. So that on the whole I cannot think that these experiments have much more than an approximate value as a criterion of the behaviour of the air under the actual conditions of school work.

If a system of heating and ventilation be adopted, as is usual in America, in which the incoming air is heated to a degree sufficient to warm the rooms without any assistance by direct heating, it is of course necessary that the inlet should be above and the outlet below in order to prevent the fresh air being at once carried off by the outlets. The hygienic disadvantages involved in the breathing of air heated in this way are referred to below, page 405.

The State Board of Health of Indiana, U.S.A., has laid down in their regulations referring to the building of schools :—

"All school-houses shall take air from outside the building, and after heating, introduce it into the school-room from a point not less than 6 nor more than 9 ft. from the floor. . . . There shall be ventilating ducts of ample dimensions to carry the foul air from each room, changing the air in each room once in

twenty minutes. Said ducts shall start from a point not to exceed 2 ft. above the floor of the room, and shall be on the same side of the room as the hot-air opening."*

It is as well, if possible, to have more than one inlet. The outlets should also be divided, both for the purpose of avoiding draught, and particularly, in the case of downward ventilation, to avoid having all the vitiated air concentrated at one point, for in that case the person sitting close to the outlet will be in a constant stream of bad air. The outlets should always be at least at large as the inlets, it being probably better to have them larger, even to as great a degree as twice the size.

Size of Openings.—By the regulation of the Board of Education the inlets, which are to be arranged in corners or positions as far as possible removed from doors or fireplaces, should provide a minimum allowance of area of $2\frac{1}{2}$ sq. in. per head. This hardly appears sufficient unless there is some means of mechanical propulsion in use. It is usually calculated that a square inch of unobstructed space will at the most allow 125 cub. ft. of air to pass through per hour,† so that for every thousand feet of air required 4 sq. in. of clear opening must be provided. Mr Edward Shaw recommends that for a standard American class-room measuring 30 by 25 ft. there should be an opening of at least 4 sq. ft., which, as the room is intended to take 48 pupils, allows 12 sq. in. per head. He goes on to say that 5 or 6 sq. ft. would be probably better.‡ Whatever system of ventilation be adopted it is of very great importance that the inlets and outlets should be of ample size, especially in the case of natural ventilation where the movement is slow. The little ventilators of perhaps 9 in. by 3 or 6 in. are comparatively useless, it is not until they are so large as to appear almost absurd to the unaccustomed eye that they are of real use. When once the fact has been thoroughly grasped that the larger the opening the less the draught, there will be more demand for sufficiently large openings. Probably more failures are due to the want of size in the openings than to any other cause.

Heating.—The ventilation of a building is naturally dependent to a large extent upon the heating arrangements, so that before considering further the question of ventilation it will be as well to describe

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* The Teaching of Hygiene in the U.S.A. Paper by Miss A. Ravenhill. *Journal of the Sanitary Institute*, April 1902.

† Ventilation and Warming, Jacob. 1894. ‡ School Hygiene, Shaw. 1901.

some of the more common methods used in warming buildings. There is no difficulty in raising the temperature inside a building to any required degree, provided that nothing more is necessary. It is when the heating has to be arranged so as not to interfere with the purity of the air or to help in the ventilation that the question becomes more complicated. It is not uncommon to find, where the heating and ventilation have been arranged for separately, that the heating engineer having undertaken to supply an apparatus that will raise the temperature in the rooms to an agreed upon degree of warmth, does so with a boiler of the smallest size that can possibly do the work ; but when it is required to heat rooms that are ventilated, and so has to heat a constant supply of cold air entering, it is quite unequal to the additional strain. As a rule, however, the two are considered together, and naturally the better the ventilation the greater the amount of heating required.

Temperature of Class-rooms.—The temperature at which it is desirable to keep class-rooms is variously estimated by different authorities. The Board of Education require that rooms should be kept somewhere between 56° and 60° Fahr., and generally speaking a room that is at 59° or 60° at the opening of school will be found comfortable. In America the regulation temperature is given as 70°. There are probably two reasons for this very high allowance—first, the relatively dry air in which, owing to the rapid evaporation, a higher temperature is required for comfort—it is commonly reckoned that in New York the degree of temperature is required to be about 5° higher than in this country to give the same sensation of warmth; and secondly, to habit, the custom in America being to heat mechanically nearly all private houses, and keep them up to a high temperature. It is not uncommon to find class-rooms there in the afternoon with the temperature standing at 76° or even 78°. Mr Shaw, an American writer, recommends 65° * as a comfortable and healthy temperature, where the degree of humidity in the air stands at 55 per cent. of saturation. In this country anything above 65° should be considered too high, and even this should scarcely ever be reached, except perhaps at the close of afternoon school, the degree for comfort and health being about 60° to 62°. Complaints of cold are not usually made until the thermometer falls below 56° Fahr. It should not be forgotten that a greater degree of heat is actually required by persons in a badly ventilated room.

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* This would correspond to 60° in this country.

The corridors, cloak-rooms, and lavatories, &c., should be kept up to a temperature of about 55°.

The more modern German Schools usually have a glass panel in the wall of the class-room, so that the schoolkeeper can see the temperature without disturbing the class, and so regulate the apparatus as required, the temperature at which the rooms are required to be kept being from 17° to 20° Cent., or 62° to 68° Fahr.

Methods of Heating.—The heat used in warming buildings is of two kinds, radiant and convected. Radiant heat is that which comes in a direct line from a heated object in the same way as light; it can similarly be screened off, and like light decreases in power with the square of the distance, so that such a source of radiant heat as a fire is of little use in warming a large space. In a small room the walls and objects in the room are warmed by the fire, and they in their turn warm the air in the room, and the pleasantness of a room warmed in this way lies in the fact that while the walls and objects in the room are warm, the air is comparatively cool, pleasant to breathe, and does not become dry. In heating with hot-water pipes there is practically no radiant heat; the air is heated by convection. As the air in immediate connection with the pipes becomes warmed, it rises, giving place to colder air, which is warmed in its turn.

Steam pipes being much hotter, give off some heat by radiation, a stove of course much more, but these highly heated surfaces tend to make the air in the room dry to an unpleasant and unwholesome degree; the organic matter in the air becomes charred, giving rise to the unpleasant and characteristic smell of a stove-heated room.

The different methods in use for heating a building are:—

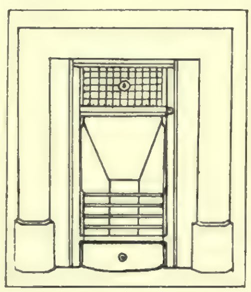
1. Ordinary grates.
2. Ventilating grates.
3. Stoves.
4. High and low pressure hot-water pipes.
5. Steam pipes.

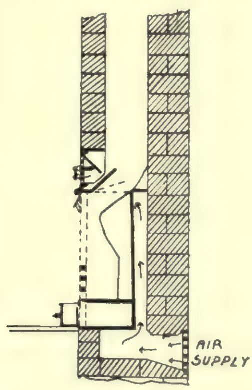
The last two are either used "directly," *i.e.*, placed themselves in the room to be heated; or for the purpose of warming air, which is then propelled into the room. This is known as "indirect" heating.

The ordinary fireplace, a cheerful and attractive, if uneconomical method, is still one of the most popular means for warming, and as it necessarily ensures a considerable amount of ventilation as well as warmth, it makes, if a good form of grate be used, an excellent though wasteful means of heating small rooms. It is, however, almost

always necessary in a room used for a class-room to have some supplementary means of heating as well. If the grate be arranged, as is frequently the case, with a good draught, open underneath, and with the chimney at the back, the fire burns very fiercely, and drawing a strong current of air, makes an unpleasant draught while very little heat is thrown out into the room, the chimney often absorbing over 90 per cent. of the heat produced. In order to warm the room a large fire has to be kept up, with the result that, since the pupils have to be placed all over the room, some are in a strong draught, some nearly roasted, the remainder merely cold. These objections can, however, be obviated to a large extent in grates of the type of the Teale Fireplace Company "Front Hob" or the "Nautilus," which, while restricting the draught, have large surfaces which heat the air by convection, and so warm the room without the heat being very fierce near the fireplace.

Ventilating Grates.—For school purposes, where there is no special apparatus to provide for the introduction of warmed air, some form of "ventilating" grate should be used; that is to say, a grate having an arrangement by which air is brought by a duct from the outside and passed over the hot back of the grate, and so admitted warm through a grating over the fireplace into the room. See Figs. 372, 373, which show a section and view of a Boyd's "Hygiastic" grate.





372. 373.

BOYD'S HYGIASTIC VENTILATING GRATE.

There are a number of excellent patterns on the market, but great care is necessary to see that the grate is carefully and properly fixed. In many cases where such grates have proved unsuccessful, the fault can be traced to ignorant or careless setting. The grate should be of some simple form so as to allow of taking to pieces easily for the periodic cleaning, which should under no circumstances be omitted. The great advantage of these grates is that by their use it is possible to bring a supply of fresh warmed air into a room at a very small cost; these grates have also great warming power for their size, since advantage is taken of the heat at the back of the fireplace, which under ordinary circumstances is entirely wasted.

Stoves.—It is not too much to say that of all forms of heating for school purposes the stove is absolutely the worst. It provides little ventilation; it heats the same air over and over again, charring and burning all the organic impurities; it reduces the air to a most unwholesome degree of dryness; and lastly, it is almost impossible to make a stove gas-tight; during the process of combustion very poisonous gases are formed, and these escape into the room through the cracks, the metal itself becoming to some degree pervious when sufficiently heated. It has one merit, that it is extraordinarily economical, and will heat a room in a very short time with very little expenditure of fuel, over 90 per cent. of the heat generated being made use of.

Stoves are sometimes used for warming fresh air that is then led into the room requiring to be heated. In this case the stove should stand in a chamber communicating with the external air and the building. The stove should be very large, so that it can give off sufficient heat without any danger of the surfaces becoming overheated, and suitable outlets from the room to be warmed must be arranged, or a due amount of air cannot gain admittance.

Hot-water Pipes.—Heating by the use of hot-water pipes, used either alone or to supplement that of open fires, is a means very commonly adopted. Although when used alone there is a loss of the cheerful appearance of the open fireplace, and also of a certain amount of ventilation, they possess many advantages. There is less labour in service; they provide a more equal distribution of heat, and they obviate the disturbance caused by making up open fires. While the initial cost of their installation is of course greater, the annual cost of their upkeep is as a rule less than that of open fires. A further advantage lies in their easy adaptability to any scheme of ventilation. Two forms are found—the low-pressure system, in which the pipes are large, 3 to 4 in. in diameter, and the temperature of which does not usually exceed 150° Fahr.; the high-pressure system, in which small pipes are used, formed to stand a considerable strain. As in this case the temperature of the pipes rises to a much higher point, often above that of boiling water, less area of piping is required. Another form known as the "limited" or "medium" high pressure, in which the pipes also are small, has been found of great use for school purposes. A system which allows the use of small pipes has certain advantages—the amount of liquid used is small, enabling heat to be produced in less time than with larger pipes; these small pipes are less unsightly, take up less room, and can

be taken into positions, such as under glass toplights, &c., where those of large bore could not conveniently be placed.

The use of steam for heating was until recent years generally confined to large workshops and similar places where the waste steam from the engine was made use of. It is, however, coming now into use for schools and other buildings, owing to the improvements made in the apparatus by American inventors. It has many advantages, being capable of quickly heating a room, and of being put in almost any position. It is apt, however, to overheat a building, and the pipes often become hot enough to cause an unpleasant smell by burning the organic impurities in the air. It requires a skilled engineer in charge of it; but it is usually found where there is already an engine for working machinery in the building, such as fans for ventilation, electric light, &c.

With regard to all these methods of heating, where steam or water pipes, or radiators are placed in the room to be heated, the result will be very bad, unless proper means are provided for the admission of fresh air, as the same air is heated again and again. "This system of heating a school-room by steam pipes placed in the room is almost sure to involve a defective air supply, yet it is one that is peculiarly attractive to those who are not qualified to judge of the relative merits of the various methods of heating, since it is comparatively cheap, and does give the requisite amount of warmth." *

The exactly opposite method is that known as the "indirect" method. In this case the incoming fresh air is heated sufficiently to warm the room. This method of warming is generally found in connection with the Plenum system, it being necessary to discharge air heated to this degree under pressure into the room.

But the introduction of air warmed sufficiently to render any other heating unnecessary has been strongly condemned on hygienic grounds. In all cases where warmed air is introduced into rooms, it cannot be too strongly urged that this should not be relied upon for the purpose of heating. Not only is air raised to this temperature enervating and unpleasant to breathe, but while the air in the room is warm the furniture and walls remain cold. As the late Sir Douglas Galton remarks in a paper read at an International Congress of Hygiene at Buda-Pesth—"The method of warming rooms by means of heated air necessarily leaves the walls colder than the air of the room, and the heat of the body is radiated to the colder walls. Hence

* Ventilation and Heating, Dr Billings, p. 417. 1898.

if the walls are to be warmed by the air admitted to the room, the temperature of the warmed air must be raised beyond what is either comfortable or healthy for breathing, and thus, if you obtain your heat by warmed air alone admitted direct to the room, discomfort in one form or the other can with difficulty be avoided."

The extremely unpleasant and disagreeable effect of sitting close to a grating from which hot air is being discharged must be within the experience of most people.

On the whole I think there can be no doubt that the most satisfactory method is that known as the "direct indirect" system, in which fresh air is discharged at a temperature just sufficiently high to prevent the feeling of cold or draught, while the actual heating is provided for by some form of radiant heat, such as open fireplaces supplemented if necessary by hot-water pipes, or by pipes and radiators alone.

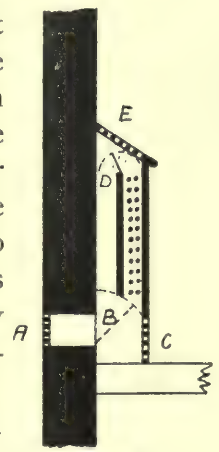
Care should be taken in the arrangement of the pipes. The practice of arranging hot-water pipes in channels below the floor with open gratings over should be unhesitatingly condemned. It is not only unnecessary but dangerous, owing to the difficulty of keeping them clean; there is in addition great loss of heating power. Hot-water coils for the same reasons should on no account have ornamental coverings. Radiators are now made in so many forms that they can usually be found to suit any position and any person's taste.

In regard to both the boiler and the area of heating surface it is most important that the allowance should be liberal. A large boiler will not only do its work more economically but last longer, and require stoking and looking to at longer intervals; and in a sudden snap of unusually cold weather, can supply an extra amount of heating power. When, as too often happens, the boiler is cut down to the lowest size that can possibly be expected to do the work, it is found necessary during the winter months to strain its capacity to the utmost, thus involving constant attention and great waste of fuel; while in case of an unusual degree of cold it is incapable of keeping the building warm.

The heating engineer will of course determine the amount of piping required to heat the building to the required temperature, making of course the necessary allowances for loss of heat through walls, &c. There are, however, one or two considerations which are sometimes apt to be overlooked. For instance, the additional heating required according to the aspect of the school, whether the building is allowed to cool down during the night, and whether certain rooms are only required for use at intervals. The following figures are taken from a lecture before the

Franklin Institute by Mr R. Wolff* on the heating of large buildings. The heating power should be increased 10 per cent. for a northerly exposure; 10 per cent. when the building is heated in the daytime only. If the building is in a particularly exposed position this should be increased to 30 per cent. If the building is used intermittently with intervals of days or weeks of non-heating, the heating power requires raising 50 per cent.

Easy and complete control of the heating power is essential to convenience and comfort. The heating in each room should be separately under the management of the occupants, so that the idiosyncrasies of different masters can be satisfied. Especially in buildings heated by steam the rooms are often intolerably hot. There are many ways in which this can be managed. The radiators or pipes in the rooms may be arranged in sections so that more or less may be used. There should be some mean between having the heat full on or quite off. In Fig. 376 it will be seen that the radiator for warming the incoming air is arranged in sections. In rooms where the air is admitted into the room over a coil of hot-water pipes fixed either in or against the wall, the inlet can be arranged with a valve or damper, so that more or less air can be allowed to pass over the pipes. This can be done in various ways. In Fig. 374 is shown a method suggested by the late Professor Jacob,† of which he gives the following description:—



374.

"The coil is enclosed in a box with a diaphragm running vertically throughout. By rotating the valve D at the upper part the stream of air is allowed to pass through the outer channel unheated, or over the coil so as to become warm, or by placing the valve in an intermediate position the air may be admitted of any required temperature. By closing the inlet valve B at the base the coil may be used entirely for heating purposes, the air circulating through the front opening C, ventilation being set up the moment the valve is opened." This should be a useful form of heating apparatus, as the coils can be used to heat the room until it is occupied, when by opening the inlet, ventilation is at once set up.

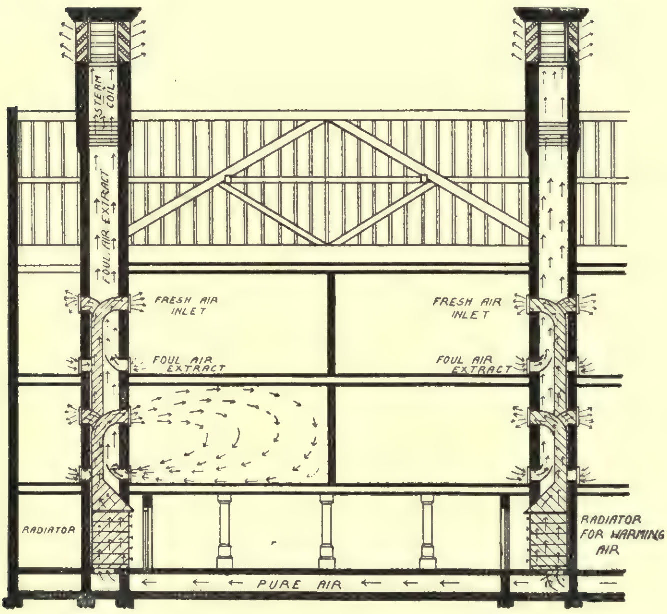
The Plenum System.—This method of combined heating and ventilating under pressure, that has come into great prominence in

* Quoted by Carpenter, The Ventilation and Heating of Buildings.

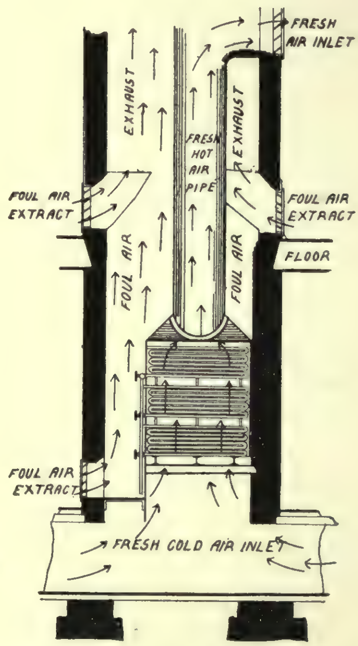
† Ventilation and Warming, p. 46.

recent years, has been already described from a theoretical standpoint. It is proposed to give here a short description of the method of its practical arrangement and working.

Fig. 375 shows a part of a school building heated and ventilated on the "Plenum" or downward system. The air is driven along the passages at the bottom, and then passes over coils of hot pipes, of which a greater or less number can be used by means of governing cocks (see Fig. 376). Each class-room has a separate flue to it. The fresh air pipes, which are shaded in the figure, discharge near the ceiling. The foul air is taken off at the floor level into the upcast shaft,



375. Section of a Building Heated and Ventilated on the Plenum System.
The fresh air pipes are shaded.



376. Part of Fig. 375 Enlarged, Showing Division of Coils, in Order to give Control of the Heating Surface.

its movement being accelerated by a coil of steam pipes placed near the top of the flue. The air is intended to move on the lines of the arrows shown in one room.

The Conway Road Board School, Birmingham (illustrated on page 335) is heated and ventilated on this "Plenum" system. The position of the inlets and outlets are shown upon the plan, and a short account of the installation and its working may be of interest.

In this building the fresh warmed air is introduced into the main

halls at about 3 ft. 6 in. from the floor, and in the class-rooms at a height of 8 ft. The extract flues below and in the same wall are carried to the main shaft in the centre of the building. The air is drawn into the building through a jute screen with water running down it by a 4 H.P. gas-engine. There is an ingenious contrivance for the blades of the propeller, the angle of which can be altered by means of a nut, and so alter the volume of air drawn in, but it must be doubtful whether an ordinary school caretaker would be competent to do this.

The air after being drawn in by the fan flows into two large parallel main ducts about 6 by 4 ft. running the length of the building, one on each side of the central hall. The air is brought in the middle of the building, the main ducts running each way away from it at right angles to the direction of the entering air. From these mains the flues to each class-room are taken off, the opening of the flue being at the highest part of the duct, and at the mouth of each flue is fixed the heating apparatus. The entrance to the flues is made with a double mouth with a flap, so that by opening one or other the air can be heated or supplied cold as may be desired, by being made to pass over the small radiator, or allowed to enter without contact with it, the amount passing in being in both cases the same. This position of the heating apparatus gives an additional upward impetus to the air. Another method which is sometimes found in connection with the Plenum system, for governing the heat to be admitted to any single room without affecting the others, is that known as the double duct system, in which there is a horizontal division formed in the main ducts, both parts being then connected to each class-room flue. The air in the upper duct only is heated, so that any class-room can draw its air from the heated or the cold duct, or can combine the two in any desired proportion.

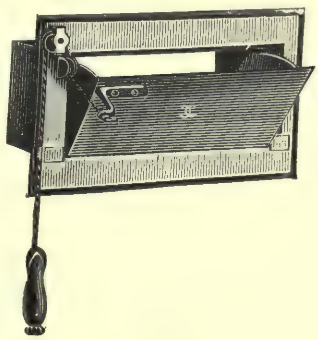
To return to the description, the flues formed in the brick-work leading to the class-rooms are 4 ft. by 9 in. The fan which draws the air into the building has a diameter of 7 ft., and is arranged to run at 250 revolutions a minute in winter, and 300 in summer. It is calculated that this will change the air in the class-rooms six times an hour, which is hardly up to the requirements demanded by modern standards for this system of ventilation. There is no buzz or hum perceptible in the building from the fan. The cost of the installation was £1,800. As regards the success of this installation, I happened to visit the school on a warm day in the beginning of July, in the afternoon, and it did not seem to me that the state of the air was satisfactory; there was a quite perceptible variation in different

rooms. In one case the inlet had been nearly doubled in size, and in this room the air was undoubtedly the pleasantest. It is of course necessary for the successful working of the Plenum system that all windows should be kept closed, and there seemed something repugnant as well as unnecessary in keeping all the windows carefully shut, and going to considerable expense to draw air through screens, and then pump it along passages into rooms with every window closed on a fine summer afternoon, especially in the case of a building as this school, standing away from buildings, in a large open playground, well out of the town, when by having all the windows open to ensure a free cross ventilation, the fresh air could have been allowed to sweep through the building, and so keep the air in the class-rooms as fresh as that outside. The conditions of the air in these class-rooms certainly compared very unfavourably with that in those of a school in Norwich, which I happened to have been visiting a few days previously, where, though the day was hot, the air in the building, with every window open, was delightfully fresh. It is quite likely that in winter the comparison would have been more in favour of the Birmingham School.

In noisy streets where double windows are necessary, or in the middle of a town near factories, or where the air may be contaminated, it is of very great advantage to have a system which will obviate the necessity of opening the windows. But in the case of schools not placed in these unpleasant circumstances, it would surely be as well to have the windows so arranged that when the cold weather is over they could be freely used. Ventilating engineers seem too apt to regard air, unless properly warmed, washed, and treated, as something dangerous.

In the ventilation and heating of large institutions where there are large rooms with considerable numbers of persons in them, it is necessary to have an elaborate installation of heating and ventilation. In these circumstances there is usually a skilled man to take control of the furnace and apparatus, and provided that the initial installation is well done, the results are highly satisfactory. Owing to the reasons given earlier in this chapter, it is suggested that the most satisfactory result will be gained by the adoption of a system which takes off the foul air at the top, and one in which the heating, although warm air is supplied, is to a large extent done by means of some system of direct heating. One thing is, I think, certain, and that is, as soon as the general lines of the system have been determined on, the whole arrangement and carrying out should be put in the hands of a really competent engineer, who should be given considerable power of discretion in order to adapt the system to the building in the best way.

Heating and Ventilation of Small Schools.—In the case of small Secondary and Private Schools it is not usually possible to afford the initial expense of a scheme of mechanical ventilation, nor the cost of maintenance involved in providing a skilled attendant, nor indeed is it really necessary. The rooms are usually of fair size, the classes small; and they are generally only used for forty minutes or an hour, when all the windows can be opened for a few minutes and be thoroughly aired. If there is a ventilating grate by which a certain amount of warmed fresh air is ensured, two ventilators such as the Sherringham (see Fig. 377), which give an upward direction to the incoming air, two extract flues of a fairly large area high up, and if possible connected to a chimney or some form of shaft with an upward draught; in addition the upper parts of the windows made to open on the hopper principle with side cheeks; and if there is no window on the opposite side, a proper ventilator over the door for the purpose of making a through current of air; it will then be found that quite sufficiently good ventilation can be obtained, provided that the means supplied are intelligently used, and that the Principal of the school will occasionally take the trouble to see that they are being so used, and insist on the rooms being thoroughly aired as soon as vacated.

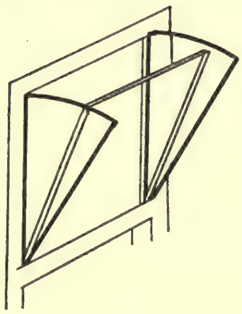


377.
A Sherringham Ventilator.

Ventilation by Windows Only.—As it often happens that a school has to be carried on either temporarily or permanently in a building where no provision at all or quite inadequate provision for ventilation is provided, the best method of utilising the windows becomes of considerable importance. This is at best only a makeshift, and in cold weather is sure to lead to a certain amount of discomfort, though it is wonderful what a difference there is in the extent to which this discomfort will be tolerated. In the same school on the same day you will find one class-room with nearly all the windows open, while another has every one shut. A master or mistress who is a believer in open windows and fresh air will keep the windows open nearly all the year round, the children becoming apparently used very quickly to the feeling of draught. But windows cannot under any circumstances be considered good ventilators. In spring and summer, when the air is mild, it is pleasant enough to have all the windows open; but in windy

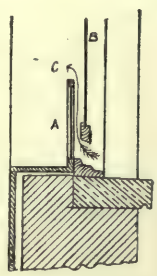
and cold weather the case is very different, or when the air is full of smoke and fog.

In the case of wind, when there are two walls to the room with windows in them, it is of course best to open the windows, if circumstances will admit, to leeward. The slight tendency to vacuum caused by the aspirating power of the wind will draw the air out, and its place will be filled by air working its way in through cracks and crevices on the windward side.



378.
HOPPER INLET FOR AIR.

As a matter of fact, however, it is more usual to find all the windows on one side of the room. The only thing that can then be done is to open two or three windows slightly at the top. The wind will then come in, and to a certain extent ventilate the room. Some of the openings will serve as inlets and some as outlets, but which will serve which part will depend upon the freaks and currents caused by the wind. There are various devices for checking the draught caused by the force of the wind. Windows can be fitted with hopper openings at the top (see Fig. 378), which have an excellent effect in turning up the current of air, but it should be remembered that the omission of the side cheeks will allow a large amount of cold air to flow down at the corners, and cause an unpleasant draught. Where the windows are not so arranged, a piece of board fastened obliquely to the top sash will do a good deal towards checking the draught. This of course interferes to some extent with the light. Fig. 379 shows the arrangement suggested originally by Hincke Bird for obtaining an upward current by means of raising one sash.

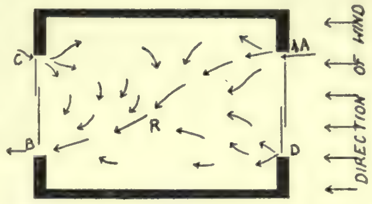


379.

The question whether the windows should be opened at the top or the bottom will be governed by the intention as to whether the opened window is intended to act as an inlet or outlet, a matter which requires a careful and intelligent observation of the conditions on the part of the teacher in control of the room. When there is little or no wind, the windows should all be opened both at the top and the bottom, the amount of course depending on the temperature. In cold weather the air will of course enter at a much greater pace. The top will then act according to the season, as an outlet in winter and an inlet in hot weather. In still weather, when the temperature indoors approximates very closely to that outside, the only means of ventilation available is that of diffusion, and all that can be done is to open the windows top

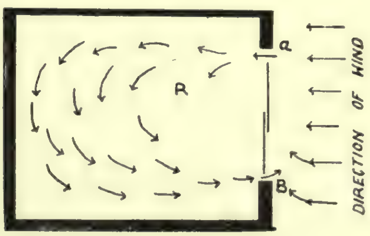
and bottom as widely as possible. It is when a strong wind is blowing that the greatest difficulty is found ; still, by a careful arrangement, it is possible to keep a fairly constant current.

In Fig. 380* is shown an arrangement of windows by which more or less satisfactory results may be obtained. This presupposes windows on two sides of the room, which makes the matter much easier. The size of the different openings should be carefully noted. By having a large opening at A and B there will be a strong current set up from A to B, as shown by the arrows. This tends to create a vacuum by drawing the air from the other corners of the room. By then slightly opening the windows at C and D sufficient air will be drawn in to replace the air drawn out, and so the whole of the room will receive a fair ventilation, although the main bulk of the incoming air enters at the top, and is so warmed a little before descending. It would hardly be possible to keep to this arrangement in very cold weather.

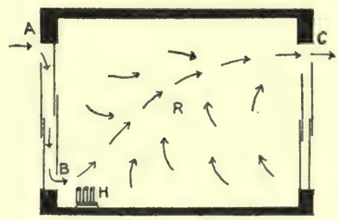


380.

Where the windows are on one side of the room only, and there is a wind blowing in the direction of the arrows, Fig. 381, if the



381.



381A.

window is opened widely at the top, and only to a small degree at the bottom, a current will be set up in the direction shown ; but unless the wind is of considerable power the current is apt to go in the opposite direction, causing unpleasant draughts, and the amount of ventilation that can be obtained will depend chiefly upon the fortitude of the children. Where there are double windows it is possible to arrange a more satisfactory system, as in Fig. 381A. In this case the air has time to become to some extent warmed before entering the room.

* The Ventilation of School Buildings, Morrison, 1901.

CHAPTER XXIII.

SANITATION.

General Considerations—Baths—Number required and arrangement of—Lavatories—Number of Basins required—Footbaths—Swimming and Shower Baths for Elementary Schools—School Baths in America—Account with Illustrations of the Baths in the German Elementary Schools—A Bath in an English Poor Law School—Constant Stream Lavatories—Sanitary Conveniences—Number, Position, &c.—Warming and Ventilation of—Details—Trough-closets—Earth-closets—Latrines—Urinals, Details—Description, and Examples.

THERE is no part of the school building for which careful and intelligent supervision is more necessary than the sanitary arrangements. Unless the Principal is prepared occasionally to look himself or herself into such matters, it is pretty nearly certain that an unsatisfactory state of things will soon begin to prevail. In order that inspection may be easy and thorough, it is essential that every part should be so thoroughly lighted that there are no dark corners anywhere where any dirt or rubbish can lurk undetected. Deodorisers or disinfectants should not be allowed, since they take away one certain and easy means by which anything wrong can be discovered. Well-arranged and sanitary closets, properly and regularly cleaned, should not give rise to any unpleasant conditions.

BATHS, LAVATORIES, &c.

Baths are not as a rule found in Day Schools of any kind, or at any rate not provided with any idea of regular use by the school. In Boarding Schools the number that have to be provided depends of course upon what other facilities there are for bathing in the way of swimming baths, and how often it is considered necessary that each inmate should have a bath.

If provision is to be made for a daily bath, it is necessary to supply at least one to every five boarders. In schools where swimming baths are provided, and a bath once a week is required, about one bath for every fifteen to twenty will be probably sufficient.

Baths are made of a large number of different materials—zinc, copper, enamelled fireclay, slate, marble, wood lined with lead, and cast iron; the last named being by far the commonest, and having many advantages, being cheap, durable, and cleanly. Fireclay and porcelain baths have the disadvantage of being very heavy and slow to take the heat of the water, giving an unpleasant chill to the person using it.

For school use it is usual to arrange the baths in a row, either with or without partitions. They should not be cased in, and stand free from the wall, to allow of easy cleaning, the best form being undoubtedly some one of the many varieties of the so-called Roman baths, of cast iron with a vitreous enamelled surface. It is as well in a school bathroom, where there are several baths, to make the floor and walls of the room of such material that no damage may be done by the splashing that is sure to take place. The floor of the bathroom may be asphalted, the waste of the baths emptying directly into an open channel down one side of the room which discharges through an opening in the wall into a rain-water head, so that there is no arrangement of pipes at all, and the whole can be easily washed; there is, too, no risk of stoppage, should anything be thrown into the baths.

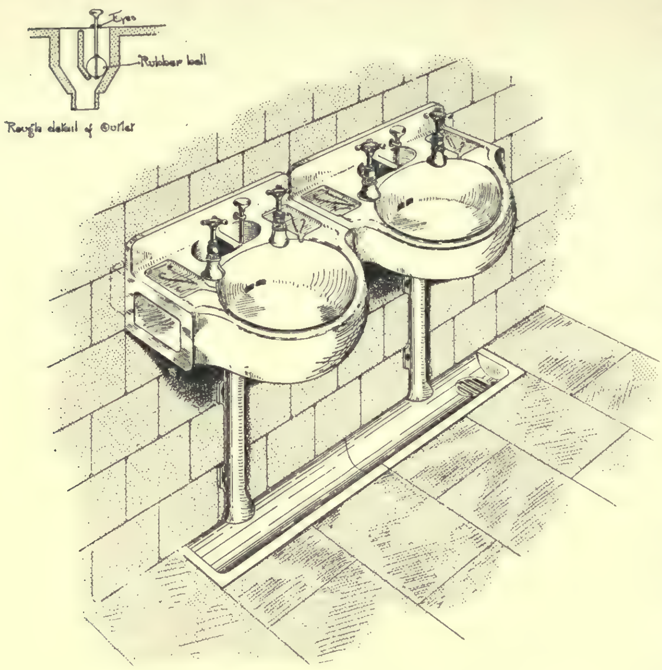
The taps, as a rule, are so arranged as to be turned on by an attendant with a key, or the hot-water tap alone may be so arranged.

In connection with the question of the provision of baths for Secondary Boarding Schools, it might well be considered whether it would not be more economical both in time and money to adopt some modification of the spray bath as used in German and American Elementary Schools, such as are described below. That shown in Fig. 393, page 423, would answer the purpose well. An arrangement of this kind would be not only less expensive in the initial cost and take up less room, but would enable a very large number to take a bath in a very short time, as there is no time wasted in emptying or filling the baths. Any possibility of the same water being used twice over is also prevented.

Lavatories.—In Secondary Day Schools, and for day use in Boarding Schools,* the number of basins supplied may be reckoned at five for a hundred boys, while in Girls' Schools rather a larger number are generally provided, say one to every fifteen girls. These numbers

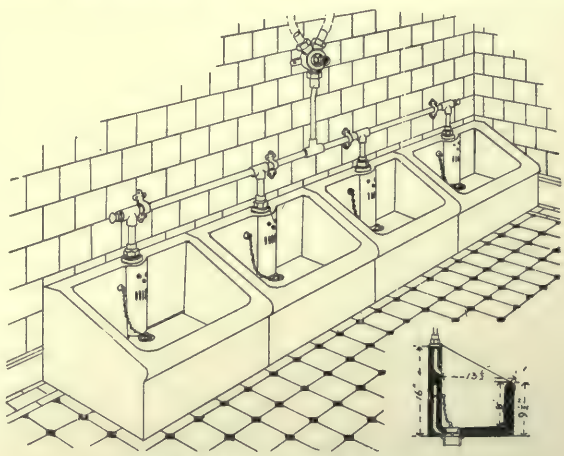
* For arrangements of basins in dormitories in Boarding Schools, see page 241.

will have to be largely increased in case many pupils stay to dinner in the middle of the day, as there will then be a large number requiring to wash at the same time. For Elementary Schools the numbers are usually reckoned at four per hundred for the boys' department, and five for the girls'. Enamelled fireclay being strong, durable, and easily cleaned, makes an excellent material. The ranges of basins with slate tops do not have a pleasant appearance. A form of basin specially designed for school work by Messrs Adams is shown in Fig. 382. These are built into the wall, and discharge into an open gulley in the floor, so allowing of easy and thorough cleansing. The arrangement of the waste should be noticed. The lavatories arranged to prevent the same water being used twice over are described below. These are usually arranged so that the water is turned on to the whole range at once, and are not usually found in Secondary Schools.



382. Lavatory Basins by Messrs Adams.

Footbaths are sometimes provided, and are a useful adjunct to a changing room or to a swimming bath, so that they can be used by boys coming to the baths straight from playing football, the best material for the purpose being glazed fireclay. Enamelled iron is also



383. A Range of Footbaths.

used. The usual plan is to provide a range of these footbaths (see Fig. 383), which shows an arrangement of Messrs Shanks. These baths are made in one piece of glazed fireclay. The water is turned on simultaneously by means of a key, and so arranged that it is impossible to turn on the hot water without first turning on the cold, thus preventing any danger of scalding. The dimensions are shown in the section, each bath occupying about 19 in. in length. In ranges of this kind it is unnecessary to trap each single bath, provided that the waste is properly trapped beyond the last fitting.

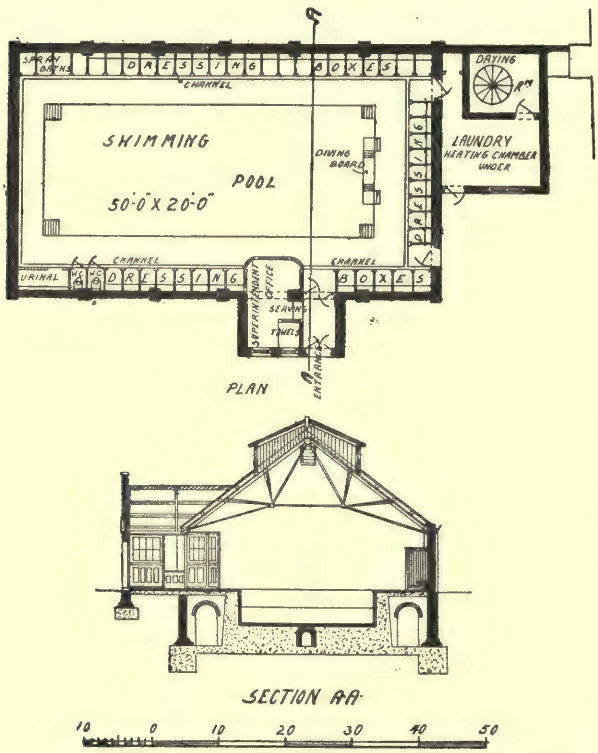
Swimming and Shower Baths for Elementary Schools.—While we have not got yet in this country to the point of systematically washing all the children in the Elementary Schools once a week, as is becoming more and more the custom in Germany and America, where in the more recently built schools very elaborate arrangements are made for this purpose, yet some of the London Board Schools have swimming baths specially built in connection with the school, and in many arrangements are made with some neighbouring baths, by which the school may have the use of the bath at certain times at special rates, though this seems to be done more in order to teach swimming than for the purpose of health and cleansing, attendance at swimming lessons being counted as attendance at school. Two Board Schools in Edinburgh (see Fig. 297 and Fig. 301) have a swimming bath placed in the basement of the school, as have also some of the Glasgow Schools. In the latest school built in Edinburgh the swimming bath has been omitted, owing apparently to objections on the part of the ratepayers. The bathing in the German Schools is effected by an arrangement of shower baths, and without any idea of instruction in swimming. It is done not only with a view to personal cleanliness and the consequent advantage to health, but it is considered also to have an excellent moral and educational value from the increased feeling of self-respect due to bodily neatness and cleanliness.

The kind of bath that is suited for an Elementary School is thus described by Mr Bailey.* The swimming pool will be 50 by 20 ft., 2 ft. 9 in. deep at one end going down to 5 ft. 6 in. at the other, lined with white glazed bricks, and having steps, diving board, and handrail. The dressing boxes should be 2 ft. 6 in. wide and 3 ft. 6 in. deep, merely formed as partitions with half doors along two sides, with a

* Paper read to the Royal Institution of British Architects, "The Planning of Elementary Schools," July 1899.

small number of larger boxes for the use of the teachers. There will have to be supplied also urinals and W.C.'s ; also four spray baths, which are considered essential for cleansing purposes before entering the swimming pool ; also, in connection with the heating apparatus, a washing and drying room for towels and bathing dresses (see Figs. 384, 385).

While it is at least doubtful whether anything approaching the system of baths recently adopted in Germany and America is ever likely to find a place in this country, it has been thought worth while to give a short account of them, as the arrangements would do admirably for a Poor Law School or similar institutions where a number of children are boarded and require baths in large numbers, the use of baths of the ordinary type being a lengthy and tedious process. This plan of providing baths in the Elementary Day Schools is a comparatively recent innovation in America, and the following remarks of a recent writer on School Hygiene in reference to it may be of interest:—



384, 385. Swimming Bath for an Elementary School.

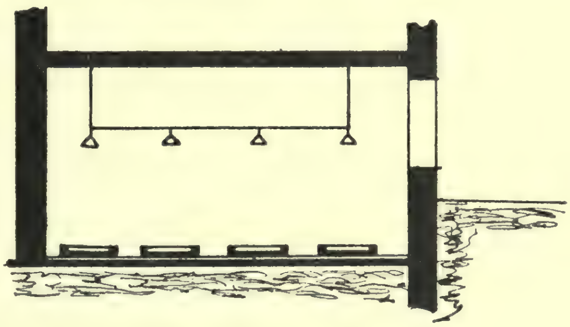
T. J. Bailey, Architect.

"The school baths established and projected in this country are for the purpose of educating certain portions of the community in bodily cleanliness. That there is such need of such education in certain parts of our cities cannot be denied. In crowded quarters, under the pressure of hard conditions and surroundings, personal cleanliness gradually becomes neglected, habits of uncleanliness are formed, and moral deterioration surely follows. The testimony of those who have instituted school baths is strong with reference to the physical and moral results arising therefrom. A child, it is found, has much more respect for himself when clean, and is much more responsive to law and order, and a positive moral influence is exerted upon the parents and homes of the children. For one thing it shows

itself in cleaner clothing for the child. It counteracts the unwholesome personal habits engendered in such homes, for the habit of bathing and cleanliness formed by the child from regular weekly baths from the age of six to fourteen will continue with him through life." *

There are plenty of schools in the poorer districts of London where these remarks would apply with equal force. It should be remarked that the bathing above referred to is not compulsory, but as a matter of fact the opportunity is taken advantage of by 99 per cent. of the pupils.

The plan usually adopted in German Schools is as follows :—There are two rooms, one of which serves as the dressing and undressing room ; in the other are arranged the shower baths, under each spray being a sort of large basin, serving the purpose of foot-washing as a preliminary to the shower bath (see Fig. 386). There should be space in the dressing-room for twice or even three times the number that can use the shower baths, in order to save time. There are many different ways of arranging the shower baths. In some cases the basins or tubs under the shower bath are as large as 5 ft., in which case there would be three pupils allowed to each.



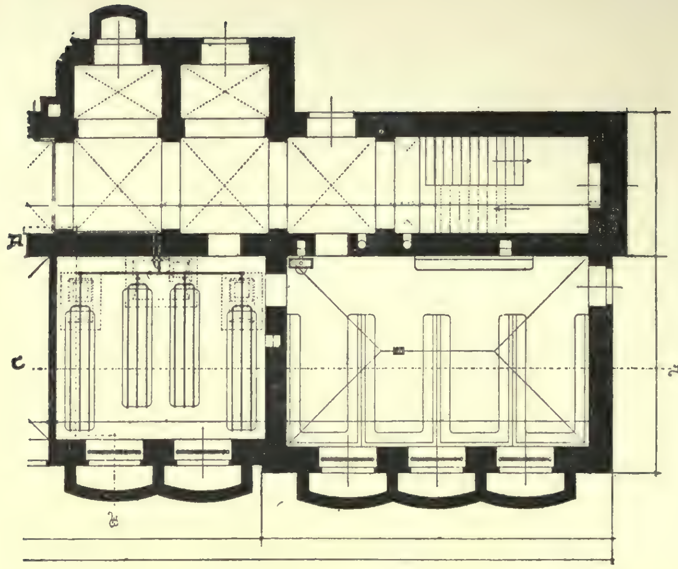
386. A Row of Shower Baths.

Sometimes a long trough is used (see Fig. 387 below), or separate little cells with a shower bath in each. The children bathe twice a week in some schools, once a week in others, but in no case are the baths compulsory.

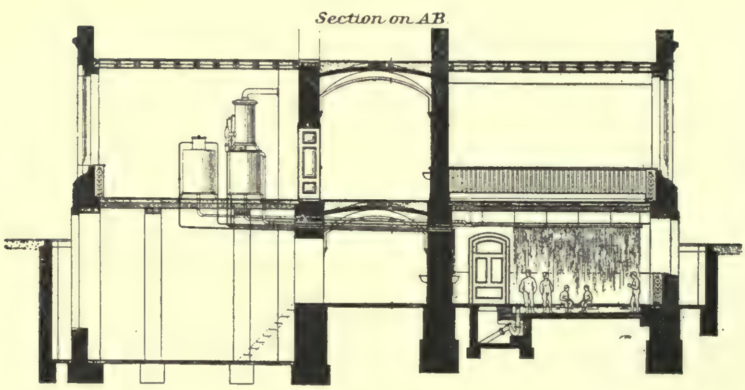
The plans and description of the baths for a school recently erected at Frankfort-on-Main are taken from a descriptive pamphlet of the schools of that town by Herr Adolph Koch, State Building Inspector of Frankfort.

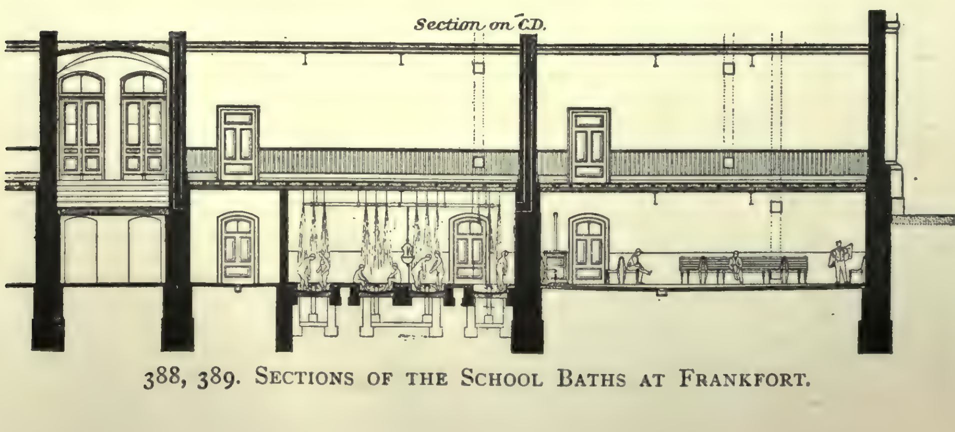
The bathing arrangements usually found in the Frankfort Schools were capable of accommodating from thirty to thirty-six children. But the great advantage of being able to deal with a whole class at a time induced the authorities in the newer schools to make the accommodation

* School Hygiene, E. Shaw, p. 133.



387. THE BATHS IN A SCHOOL AT FRANKFORT.

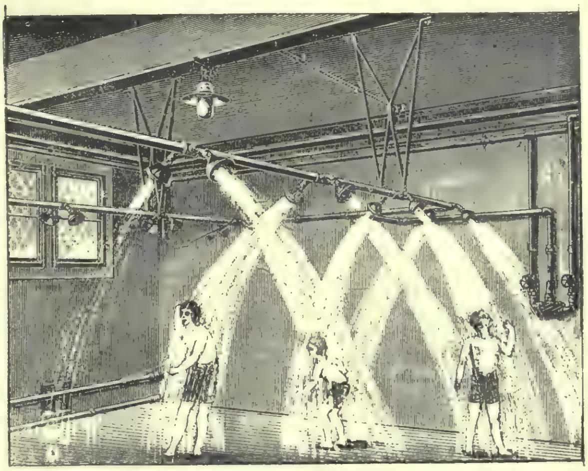




388, 389. SECTIONS OF THE SCHOOL BATHS AT FRANKFORT.

capable of dealing with sixty at once, the arrangement being as follows (see Figs. 387-389):—

There are in the basement dressing-rooms measuring 33 ft. 3 in. by 21 ft. with benches round the wall and in the middle of the room for sixty children. This room is heated by the heating apparatus of the school building in winter. When requiring heating at periods during which the main apparatus is not heating, this is done by means of a gas stove. The cement floor is covered with linoleum. The bath-room next door, a square room of about 23 ft., has sunk in the floor to a depth of about 10 in. four troughs about 13 ft. long and 3 ft. 3 in. wide, made in cement; over each of these near the ceiling are arranged three pipes running in the same direction as the troughs, the under sides of which are pierced with two rows of small holes, arranged so that the falling water shall all come within the edge of the trough. The water is heated by a gas water-heater, which will give the required temperature in a few minutes, being arranged above the level of the ceiling of the bath-room to have the necessary fall. The lower parts of the wall of this room are lined with white glazed tiles, the upper parts with waterproof paint. The baths are worked as follows:—The whole class, consisting as a rule of sixty children, after undressing in the first room, go altogether into the bath-room, take up their positions in the troughs, and sitting on the edge, wash their feet, three or four minutes being allowed for this; they then range themselves under the sprays, which are opened for two to three minutes, then the children return to the dressing-rooms. It is claimed that the whole process for a class of sixty, including dressing and undressing, can be got through in from ten to fifteen minutes, according to the age of the class. This period just corresponds with that of the recess between the two periods of work, so that a class can make use of the bath-room without any waste of time; it can then during the time of the next lesson be prepared for another batch. The cost of the whole arrangement as just described is reckoned at about 4,900 marks, or say £245. The cost of using is calculated to come to one penny per head.



390. BATHS IN A SCHOOL AT ZÜRICH.

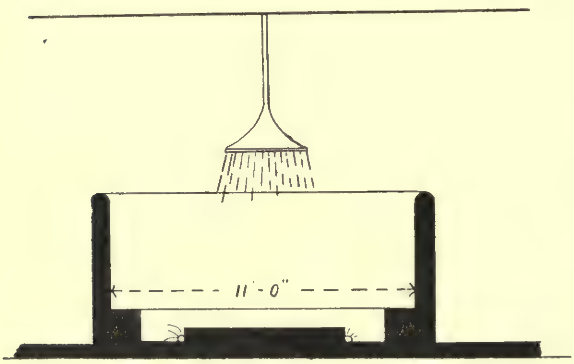
This is a rather more complete arrangement than is usually met with. Sometimes the dressing-rooms and shower baths are in the same room. The water is always turned on by an attendant who regulates

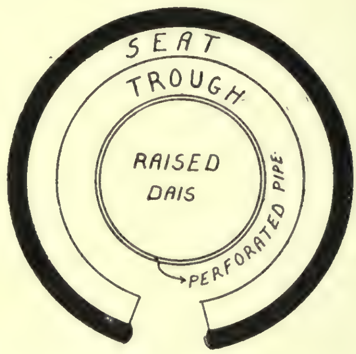
the temperature. This is usually about 113° Fahr. to start with, being gradually cooled down to 86° Fahr.

German authorities recommend that the water should not be allowed to descend vertically upon the head of the bathers. Fig. 390 shows the arrangement suggested to prevent this.

The following account of the system in America is drawn from Mr Shaw's book on School Hygiene :—

In Boston in the Paul Revere School baths have been in use since 1898. This is a school of 800 boys and girls, and 125 are bathed daily, the whole school having a bath weekly during the school year. There is a period of bathing allotted to each class as for a lesson. There are ten shower baths and thirty dressing closets. Each bath has a flexible rubber tube reaching to the floor with a spray at the end, and the occupant can direct the spray as he pleases and the amount of water. The temperature is regulated by the attendant to about





391. Section. 392. Plan.

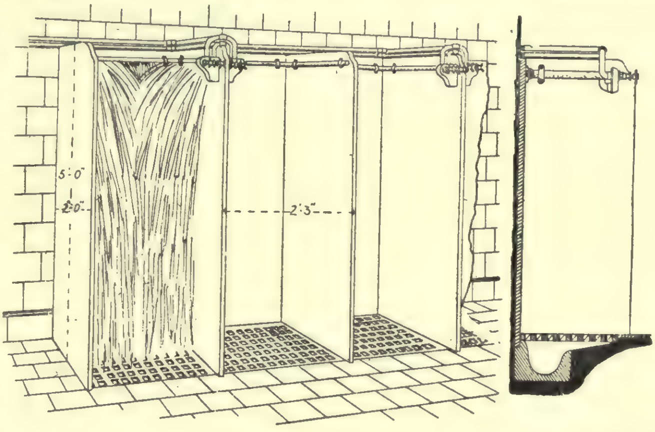
SKETCH DIAGRAM OF A FORM OF SPRAY BATH.

90°. The bath closets are made of marble with a rubber sliding screen, and measure 1 ft. 5 in. in height, 2 ft. 11 in. wide, and 3 ft. 8 in. deep. The dressing closets are made of wood and are a little narrower, being only 2 ft. 3 in. wide. Soap and towels are furnished, and the average cost is about 3½ cents. In a school just finished at New York there are baths arranged on a still more comfortable plan. There are fourteen baths, each of which combines with it a dressing closet, the whole being a sort of double compartment with a sliding door let in made of rubber, so that the bather steps from the dressing closet into the bath closet. The measurements are 7 ft. in height, 6 ft. 4 in. in depth, the width being 3 ft. 2 in. The frames are made of iron, and the sides of wired glass reaching to within 6 in. of the floor.

A somewhat similar method on a smaller scale of dealing with a large number of boys is in use at the Poor Law Schools belonging to the Edmonton Union at Enfield. The Superintendent, Mr Livocke,

finding that much time and trouble was involved in washing a large number, some 200 boys, in the ordinary baths, devised the following scheme (see Figs. 391, 392) :—

There is a circular trough formed in the floor of white glazed bricks, round which runs a seat of similar material, the whole being enclosed with a circular wall about 4 ft. 6 in. high covered with cement, in which there is an opening for entrance. Over the raised centre portion, about 7 ft. in diameter, enclosed by the trough, is arranged a large rose spray fed by water from a special gas water-heater and controlled by the attendant. At the bottom of the trough is a copper tube pierced with small holes. The *modus operandi* is as follows :—The boys, ten at a time, when undressed, enter through the opening in the centre of the wall, each boy receiving as he enters a small dab of soft soap on the head; they then sit on the edge round the trough ; the water comes into this trough through the perforated tube, and they proceed to wash their feet. Upon the completion of this they stand in a group in the centre, the water is turned on, and by means of the conveniently placed soap, a thorough cleansing is rapidly effected. This is only done in the Boys' Department.

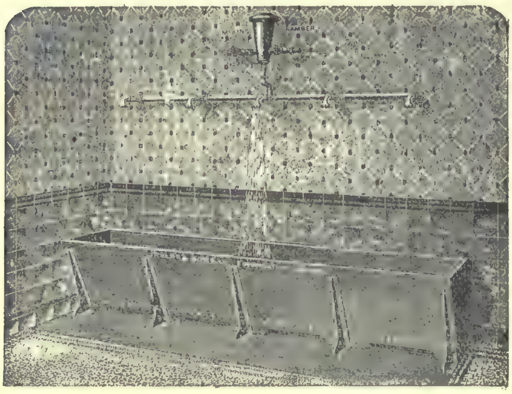


393. 394. Section.
A Spray Bath by Messrs Shanks.

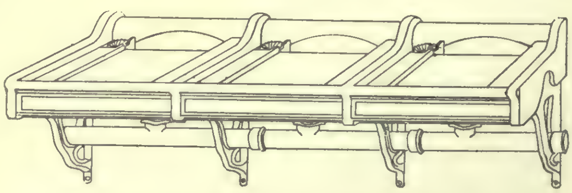
Figs. 393, 394, is a form of spray bath made by Messrs Shanks which would well serve the purpose of providing a rapid means of washing a large number or for use before entering a swimming bath. A waterproof curtain could of course be hung in front if desired. This is the form of bath that it is suggested above might well be used for Secondary Boarding Schools, since it not only provides a great economy of time, saving the filling and emptying, but takes up relatively so little space.

In both Public Elementary Schools and Poor Law Schools and similar institutions careful precautions have to be taken to ensure that two children cannot use the same water for washing in, as many diseases, especially various forms of eye disease, are thought to be communicated in this way. There are a number of ways of making it impossible for one child to wash in water previously used by the use of what are known as "constant stream" lavatories in which the water

is constantly changing. In its simplest form it consists merely of a pipe with small perforations discharging over an open grating, and so forming a kind of long shower bath. One of the earliest forms was Doulton's trough lavatory, which consisted of a long trough about 12 in. wide, with sprays about 20 in. apart, the discharges being into an open floor channel, to which the floor should slope, as there is bound to be a good deal of splashing in such lavatories. Fig. 395 shows a form of lavatory made by Messrs Tylor adapted for this purpose, each child washing in a separate spray which is kept running during use. In Fig. 396 is shown a range of Shanks' "Instanter" lavatories. The water, entering at the back, flows across the basin and over the edge down the waste, a small hole being arranged to empty the basin when the water is turned off. The water is turned on into all the basins at once by one tap, it being usual to have one basin at the end with a separate supply cock, so that if only one child requires to wash it can do so without the necessity of turning on the water to the whole range. This form of lavatory has been fitted in a large number of schools, and seems very satisfactory; the only objection I have heard to it being that owing to the shallowness of the water children have some little difficulty at first in washing.



395. A Form of Lavatory to avoid the use of the same Water twice over. By Messrs Tylor.



396. A Range of "Instanter" Lavatory Basins. Messrs Shanks.

In the schools of the London School Board basins are provided of some simple pattern. The taps, when a separate water supply is provided to each basin, should be of some strong self-closing pattern. Screw taps are very liable to be left not fully turned off. Lock taps are useful when the water is turned on by an attendant for a range of basins.

WATER-CLOSETS AND URINALS.

Position.—The position of the sanitary conveniences in a school building requires considerable care. As far as the Elementary Schools are concerned, the question is practically settled by the regulations for school buildings issued by the Board of Education, it being laid down that "water-closets within the building are not desirable, and are only required for women teachers; all others should be at a short distance, and completely disconnected from the school building." While this precaution may be necessary, and considering the appliances still to be found in many schools is sometimes certainly so, there is a considerable hardship in this arrangement for very young children in cold weather. Provided that proper appliances are used, and sufficient care be taken to cut them off from the main building by an intercepting lobby, efficiently ventilated, there should be no risk in having them attached to the main building. In America it is common to find them placed in the basement, but this can only be done in schools where an efficient system of ventilation is in force. They are as a rule cut off from the rest of the building by a lobby with self-closing doors, and are ventilated by a separate ventilating apparatus, kept carefully apart from that for the rest of the building.

In Germany, while in the older schools they were often placed on the landings of the stairs, the unpleasant conditions arising from this has led to their being placed usually outside the building, but always connected by a covered way of some sort, the separate block of sanitary conveniences approached through the open air being seldom or never found.

In Secondary Schools for boys there is usually a sanitary block separated from the other buildings, though it is also common to find them attached to the main building. In Girls' Schools they are of course always in or attached to the main building. A common plan is to make the lavatory serve as an intercepting lobby to the cloak-room, as Fig. 85. This not only answers the purpose well, but is a convenient position for the lavatory, which may with advantage also be close to the cloak-rooms. It is often found a convenience to place all the sanitary arrangements, lavatories, &c., in a spur building cut off from the main block by a cross ventilated lobby, and so arranged that access is possible from each floor. Care is required in placing closets for the mistresses that while they are in convenient positions the access should be screened from general observation.

In Boarding Schools provision has to be made for a certain

number of closets for night use only. These are arranged usually in the proportion of say two to twenty-five beds near the dormitories, with access through a cross ventilated passage, and often combined with the baths, lavatory basins, &c.

The closets and the passages or lobby leading to them should be warmed, a temperature of about 55° being sufficient. The ventilation should of course be arranged with great care to prevent any chance of back draughts. Separate sanitary blocks ventilated only by the windows or louvre outlets in the roof must be so placed that they do not come under any of the class-room windows.

Number of Fittings required.—As regards the number of closets that are required, the regulations of the Board of Education give the following table for Day Schools :*—

	For Girls.	For Boys.	For Infants.
Under 30 children - - -	2	1	2
,, 50 ,, - - -	3	2	3
,, 70 ,, - - -	4	2	3
,, 100 ,, - - -	5	3	4
,, 150 ,, - - -	6	3	5
,, 200 ,, - - -	8	4	6
,, 300 ,, - - -	12	5	8

There should be urinals in the proportion of 8 ft. per 100 boys.

This table, from the Rules issued in November 1902, shows a slight increase in the number of fittings required for girls over two hundred. These figures are usually adopted for Day Schools of all kinds. For Boarding Schools it is generally reckoned that there should be not less than fifteen per hundred in the case of girls, and ten per hundred for boys in addition to urinals.

Water-closets.—The pattern of closet best adapted for school work is that which is least liable to get out of order from ignorant or careless use ; for this reason the valve closet is probably better avoided, and some good pattern of wash-down closet selected. There are many patterns of this kind on the market, and it would not be possible to mention all the different kinds. Care should be taken to see that there is a large area of water and good depth of seal. A later development of this form is that known as siphonic wash-down closets, in which

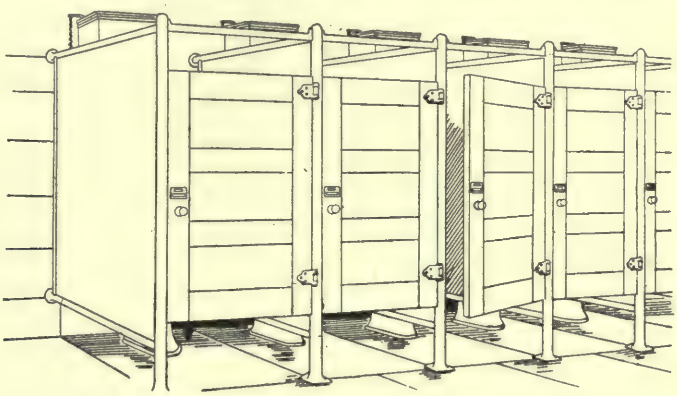
* For the arrangement of these see page 241.

advantage is taken of the additional power to be gained from the siphonic action set up by a rapid flush of water. These closets have great self-cleansing powers.

The closets should of course be of the type known as "pedestal," not covered in with any woodwork, so as to allow of easy cleaning. Closets of the bracket and projecting type, and built into the wall, allow of the whole floor being thoroughly washed.

The water supply should be abundant and the supply pipes of large diameter, since it often happens that they are all in use at the same time. The walls should be covered with glazed tiles or some material easily washable, and upon which writing is impossible; the floor so arranged that the whole can be easily washed.

In Secondary Schools it is usual to find the closets separate, each with its own supply cistern, and this is no doubt the most satisfactory



397. A Range of Closets. Messrs Shanks.

arrangement. In order to allow of easy and sufficient washing and inspection, some arrangement of the kind shown in Fig. 397, in which neither the doors nor the partitions are carried down to the floor, will prove satisfactory. In Elementary Schools some arrangement of latrines or trough closets are often found which are flushed altogether, the discharge being started by hand, or perhaps more usually automatically. In its simplest form it consists simply of a long stoneware or iron trough running beneath a number of separate seats or compartments, with an automatic flushing tank fixed at one end, set to flush the tanks at intervals regulated by the tap on the supply pipe. The trough is inclined downwards towards the outlet, where is placed a siphon trap, there being a slightly raised piece or weir at the end to ensure a certain amount of water standing in the trough. To ensure proper flushing a very large amount of water is required, as much as

50 gallons being allowed for a range of 12 ft. These trough closets are by no means satisfactory even with a large water supply, and should not find a place in a school building. In order to keep the advantage of automatically flushing a number of closets together, various arrangements of connected closets are made but trapped from each other by the water standing in the pipe between. These are generally known as "latrines," in order to distinguish them from trough closets. These latrines are usually emptied by a siphonic discharge, and certain disadvantages incident to this form are minimised by placing the discharge pipe in the centre of the range instead of at the end. The ranges are usually made with a distance of 2 ft. 3 in. to 2 ft. 6 in. from centre to centre of closet, but they can be made any distance that may be desirable up to 3 ft. 6 in. The sizes of pipes for this number of closets would be—Inside diameter of horizontal pipe, 4 in.; of trap, $5\frac{1}{2}$ in.; of feed pipe, 3 in.; while a tank measuring 36 by 30 by 18 in. is required. In order to obtain more complete isolation of each individual closet, latrines are made in which the pipe is behind the basins, each closet having an outlet at the back. As latrines of this description are usually placed in outbuildings, often unwarmed, they are very liable to damage by frost. It is therefore advisable to have them made of thick stoneware, and also to have some arrangement by which the basins and connecting pipes can be emptied, the trap at the end being of course left charged.

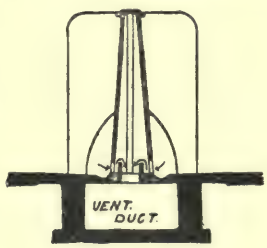
Wash-down closets of the ordinary type are often fitted in ranges, and so form latrines flushed by a single tank. The flush should in this case be two or three times the amount usually allowed for a single closet.

Earth-closets.—In the case of small schools situated in country places, it is sometimes found advantageous or necessary to resort to the system of earth-closets. While these are difficult to manage, and are unsuitable for use on a large scale, they are, provided that proper care is exercised and a good form employed, a sanitary and satisfactory method. The earth supplied should be of a loamy nature, perfectly dry and finely sifted. Sand should not be used. There should be supplied about 1 cwt. weekly for every six persons using the closet.* The earth, if kept in a dry place for about six weeks, can be used again. Ashes and peat dust are also used. The best form of earth

* The Sanitary Arrangement of Dwelling-houses, A. J. Wallis-Tayler, 1894.

closet is probably that made by the Moule's Patent Earth-closet Company.

Urinals.—Urinals should be provided in the proportion of one to every fifteen boys. These require far more care and attention both in construction and in looking after than they usually receive. It is no uncommon thing to find in schools otherwise extremely well provided and well looked after, most unpleasant conditions prevailing here. Unless liberal flushing arrangements are provided, properly arranged and freely used, inconvenience is sure to arise. Nothing but impervious materials should be used, such as glazed fireclay, or polished and oiled slate, or marble. The form of urinal very commonly found in school playgrounds is that of stalls composed of slate slabs fixed from 18 in. to 2 ft. apart, and projecting 18 in., with a sparge pipe for flushing. The slabs are usually 1½ in. thick. Effective cleansing is possible when the divisions are arranged so that they are not carried down to the floor. Holdfasts for supporting the slabs should be of copper, as iron is soon corroded. This form of urinal has the advantage of being inexpensive, and if fixed in the playground and well looked after, may be prevented from being very offensive; but owing to the corners and angles it cannot be efficiently cleaned, an objection which applies to all forms of urinals made of slabs of whatever material. A further disadvantage of slate lies in the facilities it offers for writing and scribbling on. This objection can be overcome by periodically covering the slate with a mixture of coal-tar and naphtha, which has the further advantage of preventing absorption. The slate is also much improved by oiling. Fig. 398 shows an arrangement suggested by Mr Wheelwright,* as used in American Schools, in which the ventilation duct in carried through the middle. Satisfactory results are claimed for this arrangement.



398.

The great improvement in recent years in the production of enamelled fireclay has made it possible to produce urinals of impervious non-absorptive material to which there are no angles or surfaces that cannot be easily cleaned, and which, if fitted with a good automatic flushing tank, are extremely satisfactory, and give rise to no offensive conditions.

* School Architecture, E. M. Wheelwright, 1901.

APPENDICES.

RULES FOR PLANNING AND FITTING UP ELEMENTARY SCHOOLS.

Appendix A.

RULES OF THE BOARD OF EDUCATION

TO BE OBSERVED IN

PLANNING AND FITTING UP PUBLIC

S

R 1902.

NOTE.

Owing to the fact that the regulations for Elementary School uildings were in process of revision during 1902, they were omitted rom the Code in that year, the previous Rules remaining in force or the time. The new Rules given here were issued when the ulk of the book was printed, and were therefore too late for con- ideration or mention in the body of it. To this fact is to be ttributed any slight discrepancy which may occur, in one or two stances, between the text and the New Building Rules, all refer- nces being to the Code for 1901.

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The remaining Rules are intended to aid in the production of buildings which shall be compact, properly subdivided for class teaching, conveniently arranged for effective supervision by the principal teacher and for the movement of the children from the entrances to the class-rooms, or from one class-room to another. They also indicate how to obtain the most economical school building.

No school should ordinarily be built to accommodate more than 1,000 to 1,200 children, in three departments. No single department should accommodate more than 400 children. A large school in three departments might conveniently be divided in the following proportions:—Boys, 360; girls, 360; infants, 380. For departments of this size the most suitable plan is that of a central hall, with the class-rooms grouped round it; as a rule such a department would probably require seven class-rooms. Smaller departments may be planned conveniently with the class-rooms opening from a corridor. For small schools a large room

Appendix A.

RULES OF THE BOARD OF EDUCATION

TO BE OBSERVED IN

PLANNING AND FITTING UP PUBLIC ELEMENTARY SCHOOLS

AS REVISED AND ISSUED IN NOVEMBER 1902.

Prefatory Note.

THE following Rules are to be regarded as embodying the result of the experience of the Board of Education in school planning. They are intended to show School Managers and their Architects what the Board deem essential in the construction and design of school buildings, but in other respects they are not meant to restrict liberty of treatment.

Every part of a school building should be thoroughly adapted to the work of school teaching. Such a building therefore must be provided with an ample playground, must be of sufficiently solid construction, suitably lighted and warmed, and thoroughly ventilated without draughts. It must have a sufficient number of entrances and adequate cloak-room accommodation; scrupulous care must be devoted to sanitary arrangements. The Rules which deal with these matters express in each case the principles to which the Board will expect all new buildings to conform.

The remaining Rules are intended to aid in the production of buildings which shall be compact, properly subdivided for class teaching, conveniently arranged for effective supervision by the principal teacher and for the movement of the children from the entrances to the class-rooms, or from one class-room to another. They also indicate how to obtain the most economical school building.

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with one or more class-rooms will be sufficient. There should always be at least one class-room, except in special cases.

Where the site is sufficiently large, open and fairly level, the most economical plan is that of a school on a single floor. Such an arrangement is also preferable on educational grounds. In any case it is desirable that a school building should not be on more than two floors. A building on three floors is open to many objections, and should only be proposed in special circumstances, or on very costly sites.

Before instructing an architect, managers are recommended to have careful regard to the size and circumstances of the school, and to the number and qualifications of the staff to be employed. These considerations will determine approximately the method of grouping the scholars for instruction, and on this will depend the number and the accommodation of the rooms of which the school building should consist.

The annual cost of maintenance should be borne in mind, as well as the initial capital expense.

ARTICLE 85 (*a*) of the Code provides as follows:—

All new school premises and enlargements must be approved by the Board before such new premises and enlargements are passed under this article.

REQUIREMENTS.

Plans which do not fully comply with the following requirements cannot be considered:—

I. A BLOCK PLAN OF THE SITE, drawn in ink to a scale of 20 ft. to an inch. This plan must indicate—

(*a.*) The position of the school buildings.
(*b.*) Out-buildings.
(*c.*) Playground.
(*d.*) Drains (collateral and main), with their fall and depth below ground.
(*e.*) Entrances.
(*f.*) Boundary walls or fences, and their nature.
(*g.*) Roads.
(*h.*) The points of the compass.
(*i.*) The levels of the ground at the principal points.

N.B.—For approval of site alone, the plan should show (*g*), (*h*), and (*i*).

II. A PLAN OF EACH FLOOR OF THE SCHOOL-ROOMS (AND TEACHER'S OR CARETAKER'S RESIDENCE, if any) drawn in ink to a scale of 8 ft. to an inch. The internal fittings of the rooms (*fireplaces, groups of desks, &c.*) must be accurately shown. The plan should also state whether the rooms are intended for boys, girls, or infants.

In cases of enlargement, a plan showing the buildings as they exist is needed.

III. SECTIONS and at least four ELEVATIONS, also drawn in ink to a scale of 8 ft. to an inch. The ceiling, the positions of window-heads in relation thereto, and the mode of ventilation must be shown.

N.B.—(*a.*) Pencil drawings cannot be received, but coloured tracings in ink on tracing cloth may be submitted while plans are in the preliminary stage of pencil, so that suggested alterations can be adopted without difficulty or expense.

(*b.*) Diagrams are of no value and cannot be accepted.

(*c.*) In the case of enlargements or alterations, the whole site and the existing building should be as accurately shown in every respect as the proposed changes, and in such a manner that any change of numbers can be ascertained.

(*d.*) All plans should be dated, the scales drawn on, and dimensions figured.

IV. A DETAILED SPECIFICATION separated under the several branches of the Building Trade.

V. A SECTION OF THE DESK proposed to be used, drawn to a scale of 1½ in. to a foot.

RULES.

Rule 1.—PLANNING.

Every school must be planned so that the children can be seated in the best manner for being taught. The rooms must be grouped compactly and conveniently, so as to secure proper organisation and supervision. It is important to remember that the accommodation of every room depends not merely on its area, but also on the lighting, the shape of the room (especially in relation to the kind of desk proposed), and the position of the doors and fireplaces.

The doors and fireplaces should be arranged so as to allow the whole of one side of any room to be left free for the groups of desks.

Rule 2.—CENTRAL HALLS.

A central hall should have a floor space of about 3½ but not exceeding 4 sq. ft. for each scholar for whom the school is recognised. The hall must be fully lighted, warmed, and ventilated.

(*a.*) A single central hall may be provided for the joint use, at separate times, of two departments, provided that it is so placed as to be readily accessible from the class-rooms of each department.

(*b.*) Where outdoor space is not available, physical training should be given in the central hall (or corridor). This purpose should be taken into consideration at the time when the building is planned. Since fixed gymnastic apparatus is unsuitable for children under fourteen years of age, a separate gymnasium is not required, and cannot be approved (Schedule III. of the Code, 1 and 4).

Rule 3.—CORRIDORS.

Large schools not built with a central hall must be provided with a wide corridor giving access to the rooms.

A corridor should be fully and directly lighted and ventilated, and from 8 to 12 ft. wide, according to the size of the school. Two or three of the rooms ought to be separated only by movable partitions, in order to secure flexible working.

Rule 4.—School-rooms.

A school-room should never be designed for more than 120 children, and a room of even smaller size is desirable. The proper width is from 18 to 22 ft., according to the kind and arrangement of the desks (Rule 15); but very small school-rooms need not be more than 16 ft. wide.

No school-room lighted from one side only can be approved. The gable ends should be fully utilised for windows, and there should be no superfluous windows opposite the teacher.

A school-room which has no class-room attached should not contain more than 600 sq. ft. of floor space.

Rule 5.—Class-rooms.

The number of class-rooms should be sufficient for the size and circumstances of the school.

(*a.*) The class-rooms should never be passage-rooms from one part of the building to another, nor from the school-rooms to the playground or yard. Both school-rooms and class-rooms must have independent entrances. Every room should be easily cleared without disturbance to any other room.

(*b.*) A class-room should not be planned to accommodate more than from fifty to sixty children; but in special cases somewhat larger rooms may be approved. The minimum size is 18 ft. by 15 ft., but if the desks are arranged parallel to the longer side of the room, the width should be not less than 16 ft. In the absence of supplementary light the measurement from the window-wall in a room 14 ft. high should not exceed 24 ft. 8 in.

Rule 6.—Accommodation.

The accommodation of a school for older scholars is based upon the number of children who can be seated at the desks, arranged in accordance with Rule 15, provided that a minimum of 10 sq. ft. of floor space per child is obtained.

A central hall will not be counted in the accommodation, nor will a class-room for cookery, laundry, manual instruction, drawing, or science.

Rule 7.—Walls, Floors, and Roofs.

The walls of every room used for teaching, if ceiled at the level of the wall plate, must be at least 12 ft. high from the level of the floor to the ceiling; if the area of the room exceed 360 sq. ft., the height must be not less than 13 ft., and if it exceed 600 sq. ft., then the height must be at least 14 ft.

(*a.*) The walls of every room used for teaching, if ceiled to the rafters and collar beam, must be at least 11 ft. high from the floor to the wall plate, and at least 14 ft. to the ceiling across the collar beam.

(*b.*) Great care should be taken to render the roofs impervious to cold and heat.

(*c.*) Roofs open to the apex are very undesirable. They can only be permitted where the roofs are specially impervious to heat and cold, and where apex ventilation is provided. Iron tie-rods are least unsightly when placed horizontally.

(*d.*) The whole of the external walls of the school and residence must be solid. If of brick, the thickness must be at least one brick and a half; and if of stone, at least 20 in.; where hollow walls are proposed, one portion must have the full thickness required for a solid wall.

(*e.*) All walls, not excepting fence walls, should have a damp-proof course just above the ground line.

(*f.*) The vegetable soil within the area of the building should be removed, the whole space covered by a layer of concrete not less than 6 in. thick, and air-bricks inserted in *opposite* walls to ensure a through current of air under floors for ventilation to joists.

(*g.*) Timber should be protected from the mortar and cement by asphalt or tar.

Rule 8.—Entrances.

Entrances should be separate for each department and each sex. In large schools more than one entrance to each department is desirable. (*See also* Rule 9.) The principal entrances should never be through the cloak-room. Entrance doors should open outwards as well as inwards. A porch should be external to the school-room. An external door, having outside steps, requires a landing between the door and the threshold.

Rule 9.—Staircases.

There must be separate staircases for each sex and each department. Every staircase must be fireproof, and external to the halls, corridors, or rooms. Triangular steps or "winders" must not be used. Each step must be about 13 in. broad, and not more than $5\frac{1}{2}$ to 6 in. high. The flights must be short, and the landings unbroken by steps. The number of staircases must be sufficient not only for daily use, but also for rapid exit in case of fire or panic. For any upper floor accommodating more than 250 a second staircase is essential.

Rule 10.—Cloak-rooms and Lavatories.

Cloak-rooms should not be passages, and should be external to the school-rooms and class-rooms, with gangways at least 4 ft. wide between the hanging rails, and amply lighted from the end. They should not be placed against a gable wall (*see* Rule 4). The hanging-rail should be arranged so that the children can enter and leave the cloak-room without confusion or crowding. Hat pegs should be 12 in. apart, numbered, and of two tiers. The lineal hanging space necessary to provide a separate peg for each child is thus 6 in.

Thorough ventilation is essential, so that smells are not carried into the school.

Lavatory basins are needed (*see* Rule 14 (*h*)). Girls' Schools require a larger number than boys' or infants'.

A lock-up slop-sink, water-tap, and cupboard are desirable for the caretaker.

Rule 11.—Lighting.

Every part and corner of a school should be fully lighted. The light should, as far as possible, and especially in class-rooms, be admitted from the left side of the scholars. (This rule will be found greatly to influence the

planning, *see* Rules 4, 11 (*b*) and 12 (*a*).) All other windows in class-rooms should be regarded as supplementary or for ventilation. Where left light is impossible, right light is next best. Windows full in the eyes of teachers or scholars are under no circumstances approved. In rooms 14 ft. high any space beyond 24 ft. from the window-wall is insufficiently lighted. (*See* Rule 5 (*c*).)

(*a*.) Windows should never be provided for the sake merely of external effect. All kinds of glazing which diminish the light and are troublesome to keep clean and in repair must be avoided. A large portion of each window should be made to open for ventilation and for cleaning.

(*b*.) The sills of the main lighting windows should be placed not more than 4 ft. above the floor; the tops of some windows should reach nearly to the ceiling, with a portion made to swing. The ordinary rules respecting hospitals should here be remembered. Large spaces between the window-heads and ceiling are productive of foul rooms.

(*c*.) Skylights are objectionable. They cannot be approved in school-rooms or class-rooms. They will only be allowed in central halls having ridge or apex ventilation.

(*d*.) The colouring of the walls and ceilings and of all fittings in the rooms should be carefully considered as affecting the light. This point and the size and position of the windows are especially important in their bearing on the eyesight of the children.

Rule 12.—Ventilation.

The chief point in all ventilation is to prevent stagnant air; particular expedients are only subsidiary to this main principle.

Apart from open windows and doors, there must be provision for copious inflow of fresh air, and also for the outflow of foul air at the highest point of the room. The best way of providing the latter is to build to each room a separate air chimney carried up in the same stack with smoke flues. An outlet should be by a warm flue or exhaust, otherwise it will frequently act as a cold inlet. Inlets are best placed in corners of rooms furthest from doors and fireplaces, and should be arranged to discharge upwards into the room. Gratings in floors should never be provided. Inlets should provide a minimum of 2½ sq. in. per child, and outlets a minimum of 2 in. All inlets and outlets should be in communication with the external air.

Besides being continuously ventilated by the means above described, rooms should as often as possible be flushed with fresh air admitted through open windows and doors. Sunshine is of particular importance in its effects on ventilation, and also on the health of children.

(*a*.) Although lighting from the left hand is considered so important, ventilation demands also the provision of a small swing-window as far from the lighting as possible, and near the ceiling.

Rule 13.—Warming.

The heat should be moderate and evenly distributed so as to maintain a temperature of from 56° to 60°. When a corridor or lobby is warmed, the rooms are more evenly dealt with, and are less liable to cold draughts. Where schools

are wholly warmed by hot water, the principle of direct radiation is recommended. In such cases open fireplaces in addition are useful for extra warming on occasions, and their flues for ventilation always.

(*a.*) A common stove, with a pipe through the wall or roof, can under no circumstances be allowed. Stoves are only approved when—

(i.) provided with proper chimneys (as in the case of open fires);

(ii.) of such a pattern that they cannot become red-hot, or otherwise contaminate the air;

(iii.) supplied with fresh air, direct from the outside, by a flue of not less than 72 in. super.; and

(iv.) not of such a size or shape as to interfere with the floor space necessary for teaching purposes.

(*b.*) A thermometer should always be kept hung up in each room.

(*c.*) Fireplaces and stoves should be protected by fire-guards.

Rule 14.—SANITARY ARRANGEMENTS.

Water-closets within the main school building are not desirable, and are only required for women teachers. All others should be at a short distance and completely disconnected from the school. Privies should be fully 20 ft. distant.

(*a.*) The latrines and the approaches to them must be wholly separate for the two sexes. In the case of a Mixed School this rule especially affects the planning. Passages or corridors should not be used by both sexes; where such an arrangement is unavoidable, there must be complete supervision from the class-rooms by sheets of clear glass.

(*b.*) Each closet must be not less in the clear than 2 ft. 3 in. wide, nor more than 3 ft., fully lighted and ventilated, and supplied with a door. The doors should be at least 3 in. short at the bottom and at least 6 in. short at the top. More than one seat is not allowed in any closet.

(*c.*) The children must not be obliged to pass in front of the teacher's residence in order to reach their latrines.

(*d.*) The following table shows approximately the number of closets needed:—

	For Girls.	For Boys.	For Infants.
Under 30 children - - -	2	1	2
,, 50 ,, - - -	3	2	3
,, 70 ,, - - -	4	2	3
,, 100 ,, - - -	5	3	4
,, 150 ,, - - -	6	3	5
,, 200 ,, - - -	8	4	6
,, 300 ,, - - -	12	5	8
There should be urinals in the proportion of 8 ft. per 100 boys.			

(*e.*) Earth or ash closets of an approved type may be employed in rural districts, but drains for the disposal of slop and surface water are necessary. Cesspits and privies should only be used where unavoidable, and should be at a distance of at least 20 ft. from the school. [Building Form "A," which may be

obtained on application, gives suggestions as to their construction and arrangement.] The proximity of drinking wells should be carefully avoided.

(*f.*) Soil-drains must always be laid outside the building (on a hard even bottom of concrete) in straight lines with glazed stoneware pipes, carefully jointed in cement and made absolutely water-tight. A diameter of 4 in. is sufficient unless for drains receiving the discharge of more than ten closets, when the diameter should be 6 in. The fall should never be less than 1 in 30 for 4 in., and 1 in 40 for 6 in. drains. An inspection opening or chamber should be provided at each change of direction so as to facilitate cleansing the drain without opening the ground. Every soil-drain must be disconnected from the main sewer by a properly constructed trap placed on the line of drain between the latrines and the public sewer. This trap must be thoroughly ventilated by at least two untrapped openings ; one being the 4 in. soil-pipe carried up full size above the roof, and the other an inlet pipe connected with the side of the trap furthest from the public sewer. Automatic flushing tanks are desirable where trough closets are used.

(*g.*) Urinals must in all cases have a sufficient supply of water for flushing.

(*h.*) Waste pipes from sinks or lavatories should be first trapped inside and then made to discharge direct through an outer wall over a trapped gully.

Rule 15.—Desks.

Seats and desks should be provided for all the children, graduated according to their ages, and placed at right angles to the window-wall. (*See also* Rules 4 and 11.) The seats should be fitted with backs.

An allowance of 18 in. per scholar at each desk and seat will suffice (except in the case of the dual desk), and the length of each group should therefore be some multiple of 18 in., with gangways of 18 in. between the groups and at the walls. In the case of the dual desk the usual length is 3 ft. 4 in., and the gangways 1 ft. 4 in.

(*a.*) No desks should be more than 12 ft. long. In an ordinary class-room five rows of long desks or six rows of dual desks are best ; but in a school-room or room providing for more than 60 children, there should not be more than four rows of long desks or five rows of dual desks.

If a school-room is 18 ft. wide, three rows of long desks or four of dual desks may be used ; if the width is 22 ft., the rows may be four and five respectively.

Long desks should be so arranged that the teacher can pass between the rows. Where dual desks are used this is not necessary, as the gangways give sufficient access.

(*b.*) The desks should be very slightly inclined. An angle of 15° is sufficient. The objection to the flat desk is that it has a tendency to make the children stoop. A raised ledge in front of a desk interferes with the arm in writing. The edge of the desk when used for writing should be vertically over the edge of the seat.

(*c.*) Single desks are not necessary in an ordinary Public Elementary School, and cannot be approved.

Rule 16.—Sites and Playgrounds.

Every school must have an open airy playground proportioned to the size and needs of the school, and the site should, if possible, have a building

frontage in proportion to its area. A site open to the sun is especially valuable for the children, and important in its effects on ventilation and health. The minimum size of site is, in the absence of exceptional circumstances, a quarter of an acre for every 250 children, irrespective of the space required for a teacher's or caretaker's house, or for a cookery or other centre. If the school is of more than one storey, this area may be proportionally reduced ; but a minimum unbuilt on or open space of 30 sq. ft. per child should be preserved.

(*a.*) In the case of a Mixed School of large size, playgrounds should be separate for boys and girls, and should, where practicable, have separate entrances from the road or street.

(*b.*) All playgrounds should be fairly square, properly levelled, drained, and enclosed. A portion should be covered, having one side against the boundary wall. A covered-way should never connect the offices with the main building ; buttresses, corners, and recesses should be avoided.

(*c.*) An Infants' School should have its playground on the same level as the school, and a sunny aspect is of special importance.

Rule 17.—Infant Schools.

Infants should not, except in very small schools, be taught in the same room with older children, as the methods of instruction suitable for infants necessarily disturb the discipline and instruction of the other scholars. Access to the infants' room should not be through the older children's school-room.

(*a.*) The partition between an infants' room and any other school-room should be imperious to sound, and there should be no habitual means of direct communication other than an ordinary door.

(*b.*) An Infants' School and playground must always be on the ground floor.

(*c.*) No infants' class-room should accommodate, as a rule, more than sixty infants.

(*d.*) A space in which the children can march and exercise should be provided. A corridor intended for this purpose should not be less than 16 ft. wide.

(*e.*) The babies' room should always have an open fire, and should be maintained at a temperature of not less than 60°.

(*f.*) In Infants' Schools an allowance of 16 in. per child at long desks will be sufficient. Dual desks should be 3 ft. long.

(*g.*) The accommodation of an Infants' School is based upon the number of children who can be seated at the desks provided that a minimum of 9 sq. ft. of floor-space per child is obtained.

Rule 18.—Rooms for Cookery, Manual Instruction, &c.

As a rule a single room for cookery, or laundry work, or manual instruction, or science, or drawing, will serve for more than one school if provided as a centre in a convenient position. Every such centre should have its own lavatory and cloak-room.

Large schools, or schools of an exceptional type, may sometimes require special rooms for their exclusive use.

(*a.*) *Cookery.*—A cookery room should be capable of accommodating 12 to 18 at practice or 36 to 54 at demonstration at any one time. The larger size

will require 750 superficial ft. and 10,500 cub. ft. Provision for instruction in scullery work is necessary.

The sink should be placed in full view of the teacher and children, and should be fitted with a cold water supply and a waste-pipe.

There should also be a gallery or raised platform, with desks to accommodate 36 to 54 children, according to the size of the room.

The floor space for practical work should afford about 20 sq. ft. for each scholar, and should not be encumbered with desks, cupboards, or stoves.

In cookery rooms the ventilation needs special arrangements. Where a gas-stove is used it may be necessary to have a pipe fixed to carry off noxious fumes. The temperature should not be allowed to rise above 70°.

The apparatus for lessons in cookery should include such stoves and other appliances as are usually found in the homes of the children.

(*b.*) *Laundry Work.*—A laundry should be of simple construction, and entirely apart from the ordinary school buildings.

The proper size for a laundry is about 750 sq. ft. It should have a gallery or raised platform with desks for forty-two children.

Laundry tables should be large enough to allow at least 3 ft. of space for each child when ironing.

The ventilation of rooms for laundry work needs special arrangements.

(*c.*) *Manual Instruction.*—In its plan, arrangements, construction, lighting, and ventilation a manual instruction room should be modelled on a workshop rather than on a school. The construction should accordingly be simple. The roof may be either of lean-to or other ordinary form, according to circumstances. Its height at the windows in front of the benches need not be more than 10 ft. The light must be ample. The temperature should not be so high as in an ordinary class-room. A flat ceiling is not, as a rule, necessary. Ample ventilation should be provided by inlets at a height of 5 ft. from the floor, and by outlets at the highest point.

(*d.*) *Science Room.*—A room suitably fitted for elementary practical work in science may be provided for the use of one large or several contributory schools. Such a science room should not, as a rule, contain more than 600 sq. ft. of floor space. It should be fitted with strong and plain tables, sinks, cupboards, and shelves, and, where necessary, a fume closet. A proper supply of gas is necessary.

In addition to a science room, one of the ordinary class-rooms may be fitted with a simple demonstration table and gas and water supply. But a special lecture room cannot be approved in an ordinary Public Elementary School.

(*e.*) *Drawing Class-rooms.*—A drawing class-room can only be sanctioned where it is likely to be used for a reasonable time every week by the scholars from one large or several contributory schools. A suitable size for such a room is 600 sq. ft. of floor space.

Rule 19.—Higher Elementary Schools.

For a Higher Elementary School accommodating from 300 to 350 scholars, 10 class-rooms will generally be required, since every class should have its own class-room. No class-room should accommodate more than forty scholars.

(*a.*) (i.) The class-rooms may be furnished with single or dual desks as may be desired. Single desks should be 2 ft. long, arranged in pairs with intervals of 2 in. and gangways of 2 ft.

(ii.) If single desks are adopted, a class-room should have an area of about 16 sq. ft. per scholar. Class-rooms fitted with dual desks need not be so large, but a minimum of about 13 sq. ft. per scholar will be required.

(*b.*) Every Higher Elementary School should be provided with suitable laboratories.

(i.) The laboratory accommodation must be sufficient to provide at one time for the largest class in the school.

(ii.) There should generally be one laboratory for chemistry and one for physics.

(iii.) A laboratory should afford 30 sq. ft. of floor space for each scholar, the minimum size will therefore be 600 sq. ft., but it is as a rule desirable that the laboratory should be somewhat larger. If, however, the laboratory accommodates more than twenty-five scholars a second teacher would be required.

(iv.) Laboratories must be fitted with suitable tables, which must be well lighted; they should be properly supplied with gas and water. For chemical laboratories, sinks, cupboards, and the necessary fume closets must be provided.

(v.) A small balance-room may be provided if desired.

(*c.*) (i.) In addition to the class-rooms and laboratories a Higher Elementary School may include a lecture room, which should be fitted with (1) a demonstration table furnished with a gas and water supply and a sink, and (2) a fume closet. A lecture room should have an area of about 750 sq. ft.

(ii.) If no separate lecture room is provided, each of the class-rooms used by the third and fourth years should be fitted with a simple demonstration table.

(iii.) A small preparation room, fitted with bench, sink, cupboard, and shelves, and proper supply of gas should be provided in a convenient position.

(*d.*) A drawing class-room for the more advanced drawing is desirable. It should provide 30 sq. ft. of floor space for each scholar; the best size will be a room with an area of 750 square feet. If suitably lighted, the hall would answer for this purpose.

(*e.*) Other special rooms for cookery, laundry work, and manual instruction should be provided in accordance with Rule 18.

(*f.*) A Higher Elementary School should be planned with a central hall; but no class, other than drawing, can be recognised in such a hall. Good dimensions for such a hall would be 50 ft. by 25 ft.

Rule 20.—TEACHER'S HOUSE, &c.

The residence for the Master or Mistress should contain a parlour, a kitchen, a scullery, and three bedrooms; and the smallest dimensions which the Board can approve are—

For the parlour - -	14 ft. by 12 ft.	of superficial area.	9 ft. in height to wall-plate.
For the kitchen - -	12 ft. by 12 ft.		9 ft. in height to wall-plate.
For one of the bedrooms	14 ft. by 12 ft.		8 ft. if ceiled at wall-plate; or 7 ft. to wall-plate, and 9 ft. to ceiling.
For two other bedrooms	12 ft. by 8 ft.		

(*a.*) The residence must be so planned that no room is a passage room, and that the chimneys are not all on the external walls.

(*b.*) There must be no internal communication between the residence and the school.

(*c.*) Windows should be carried up as nearly to the ceiling as practicable.

(*d.*) There must be a separate and distinct yard, with offices.

(*e.*) No dwelling-house should be built as part of the schoolhouse.

Rule 21.—Loans.

The Board do not entertain applications for loans in respect of expenditure incurred without their previous sanction, which is based on plans, specifications, and actual tenders. Applications for loans should therefore include all the items in the first instance.

In order to secure due economy and the avoidance of confusion at completion, a provisional prime-cost amount of not more than 2½ per cent. may, if considered desirable, be included in building contracts, in view of unavoidable contingencies; but the contract should contain a clause that no claim for extras can be even considered unless the work has been ordered in writing by the architect and the order bears the counter-signature of the Clerk of the School Board.

Rule 22.—Limits and Allowances.

No loan of money can be obtained from the Public Works Loan Commissioners unless the whole cost of the school, exclusive of site, legal expenses, extra rooms for instruction authorised by the Code, and residences (if any), is kept within the sum of £10 per child accommodated.

(*a.*) Additional allowances will be made on the following scale:—

For a central hall or corridor - -		£0 15 0	per sq. ft.
„ cookery or laundry room - -		1 0 0	„
„ manual instruction room	£0 10 0 to	0 15 0	„
„ science room, laboratory, or drawing class-room - - -		1 0 0	„
„ teacher's room - - -		0 15 0	„
„ teacher's house	£500 0 0 to	750 0 0	
„ caretaker's house -	not more than	400 0 0	

For glazed bricks and fire-proof floors (when necessary) allowance will be made according to the circumstances of the case.

Allowance for mechanical ventilation will only be made in districts where the air ought to be filtered before entering the building.

(*b.*) No additional allowance will be made in respect of any room which exceeds the maximum size specified in these Rules, in so far as regards such excess.

(*c.*) Whether the necessary loan be borrowed in the open market or not, extravagant plans cannot be approved.

APPENDIX B.

SCHOOLS FOR BLIND OR DEAF CHILDREN.

FROM THE CODE OF 1901.

BUILDING RULES.

SCHOOLS for the blind and the deaf should not be held in the same building.

The following rules should be read in connection with the general rules laid down in Schedule VII. of the Day School Code as to drainage, warming, and ventilation.

RECREATION GROUNDS.

Where no field or other larger space has been secured, the superficial area of the site should be not less than 30 sq. ft. per child. The recreation grounds for girls and boys should be separate. There should be a covered gymnasium, or large shed open on one side, provided with ample top light, which, under supervision, may be used by boys and girls together.

SCHOOL-ROOMS.

The area should be not less than 20 sq. ft. per child, and the cubic contents not less than 240 cub. ft. The position should be on the ground floor, near the playground. Where boys and girls are taught in one room, the exits should be separate.

The light should be such as to suit the mode of teaching employed.

The children should, as a rule, be arranged in a semicircle around the teacher, and provided with top light in order to enable the teacher to see, in the case of the blind, every change of facial expression, and in order that in the case of the deaf the teacher and scholars may observe closely the action of the lips.

Where the children are not arranged in a semicircle, the light should be ample from both sides of the room.

DAY ROOMS.

These should be of at least the same size as the school-rooms.

DINING-ROOMS.

These should be of sufficient size to seat each child comfortably, with space for the passage of waiters. There should be a minimum of 6 sq. ft. per child.

Dormitories.

The minimum width should be 18 ft., the minimum area should be 36 sq. ft. per child, and the minimum cubic capacity 360 cub. ft. per child. A separate bed must be provided for each child, with sufficient space between the beds.

A dormitory should be supervised by means of a window in the bedroom of the officer in charge. In houses or homes having small bedrooms, the officer's bedroom should be closely adjoining on the same floor, and the doors of the bedrooms left wide open at night.

No boys over nine years of age should be lodged with girls, unless in a distinct wing approached by a separate staircase.

Boys under nine years of age may be lodged with girls, but must have separate sleeping rooms.

Each teacher should also have a separate room.

Sick Rooms.

These should be separate for each sex, and should consist of two rooms in each case, viz., one for the patients and the other for the nurse.

A detached building is also necessary for infectious cases, except in the neighbourhood of an hospital to which cases can be readily conveyed.

Baths.

These should be supplied with hot and cold water, and should be sufficient to enable each child to obtain a bath at least once a week in winter and twice in summer. There must be a separate towel for each child. Lavatory basins should be sufficient to enable each child to wash the hands, face, and upper portion of the body morning and evening. No two children may wash at once at the same basin.

Latrines.

For Day.—The provision of closets should be 10 per cent. on the number of boys, together with a urinal; and 15 per cent. on the number of girls.

For Night.—One or two closets should be provided adjoining the dormitories, but disconnected therefrom by a lobby having a current of air by windows on two sides.

Staircases and Corridors.

These must be fireproof.

Fire Escapes.

Where only one staircase exists, or where the dormitories are at some distance from the staircases, fire escapes should be provided.

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